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19

Technical Training in Independent Broadcasting

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Introduction

by R. C. Hills

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In the Middle Ages, the traditional way in which new entrants to a profession learned their trade was by apprenticeship to an established and experienced practitioner. They learned what to do and how to do it by example. After a period of employment in such a fashion, they were judged by their peers to be ready—or, presumably, otherwise—to practise their trade in their own right and to take their turn in training others. For several hundred years this was the traditional and indeed almost the only way in which both trade and profession were learned, and it was only in comparatively recent times that structured tuition, both academic and vocational, has replaced this practice of learning at the mother's knee.

Training in Independent Broadcasting has been a microcosm of history. Both within the IBA and the programme companies, the first staff were recruited from the ranks of the already trained and, as establishments grew, the newcomers learned very much 'on the job'. Although that proved adequate to meet the needs of the industry up until the mid-1960s, the weaknesses of such a practice were increasingly shown up by the enormously rapid growth in the technology which had its effects not only on those responsible for the technical performance behind the scenes but also on those, technical and non-technical alike, who work with and in front of the camera and the microphone. New production techniques made possible by the new technology have swept into the programme making field and have brought with them a vital need to train and retrain in order to exploit them to the full.

This issue of IBA Technical Review aims to show what is now being done throughout Independent Broadcasting towards training in both the technical and operational areas, to ensure that both the Television and Radio services maintain their reputation for excellence which they have established over the years and for which they are justly proud.

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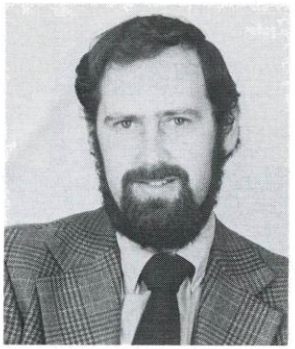

The Harman Engineering Training College, Seaton

by W. A. Atherton

Synopsis

Broadcast engineering, in common with other areas of electronics, is a wide ranging and rapidly changing field of modern engineering. Engineers who are new to broadcasting, and established broadcast engineers, require training and retraining if they are to keep up-to-date and perform effectively and efficiently in their chosen profession. The Harman Engineering Training College originates and conducts internal and external courses for vocational training in the specialist areas of broadcast engineering. Most, though not all, of the students are from within the IBA.

INTRODUCTION

Ever since electronic engineering began, around 1912, years before the word itself was coined, it has proved to be a field of engineering which has always been subject to change. In particular the Second World War brought about a quantum leap in the rate at which fundamental changes were inflicted on the then radio engineer. The pace of such changes has continued unchecked since that time and has, if anything, increased in recent years. The electronics engineer has, therefore, learned to live with, and even appreciate, the challenge of quite radical changes in his profession, be they those associated with the advent of the transistor in the 1950s, or those associated with the microprocessor invasion of today.

The broadcast engineer is no exception to this general rule. Besides coping with the arrival of new and fundamental devices he has learned to handle other innovations such as the arrival of colour television, the change from VHF to UHF frequency bands, monitoring by telemetry, and stereo radio. The most recent advances to be thrust his way are those concerned with such areas as data transmission, as in Teletext, advanced remote monitoring and control of transmitter equipment, and the general shift from linear electronics to digital electronics which includes the software engineering associated with microprocessors. In the near future he may have to acquire competence in such areas as high-level language computer programs, high definition television, digital television, and satellite broadcasting, amongst others.

Since his career is so subject to frequent and fundamental changes, a once and for all technical education is as inadequate for the needs of the broadcast engineer as it is for any other specialist electronics engineer. A continual re-assessment of his needs, and some form of re-education and retraining, is vital if he is to be able to maintain his status as a competent professional. This re-assessment, re-education and retraining can be performed adequately, on their own behalf, by a few exceptional individuals but not by all; usually because the required material and technical resources, and the

Fig. 1. The Harman Engineering Training College (HETC) occupies these premises (formerly the Stella Maris Convent School) in the town of Seaton, East Devon.

time needed, are not available. For most engineers a better means to the required end is to allow this specialist task to be placed in the hands of others.

Because broadcasting has its own specialised fields of interest, training and retraining is also required by established engineers who move into an area new to them, and by trainees for whom broadcasting is a completely new field of endeavour. For such personnel, as well as for the established engineer whose knowledge needs updating, the IBA established its own training college in 1976 at Seaton in Devon.

The need for engineering training within the IBA was not new in 1976; some degree of training has been required ever since the ITA, as it then was, came into existence in the mid-1950s. At various times prior to the setting up of its own college this need was met by courses run for the Authority by the Marconi College in Chelmsford, by training given by a small team of engineers at the Authority's Headquarters in London, by courses organised at Plymouth Polytechnic and Leeds Polytechnic, and by a small Training Unit at the Stockland Hill Transmitter Station in Devon. When engineering training within the IBA was reorganised in the mid-1970s the staff of the Stockland Hill Training Unit became the nucleus of the new Harman Engineering Training College (HETC) at Seaton. The College is named after R. C. Harman who, as the Head of the Operations and Maintenance Department of the ITA, was the prime mover behind the Marconi College courses. Since its inception the Harman College has met the IBA requirements for the re-assessment, re-education and retraining of established broadcast engineers and the initial training of people new to broadcasting. To do this a number of long and short courses have evolved and have been delivered at the College, and self-tuition distance learning packages on specialised topics, with which the student teaches himself on site, have been sent into the field.

Since its inception the College has grown considerably. New laboratories and teaching areas have been added and a new administrative building acquired, but the growth of the College is perhaps best seen by its staffing requirements. At its foundation the teaching staff consisted of only three instructors with eight other staff. Sixteen students could be trained, mostly on short courses of up to four weeks duration with a maximum of eight students per course. By the end of 1981 the full time staff had become a principal, six instructors, a training projects officer, five laboratory technician-demonstrators, a staff of five for administration, clerical and graphics duties, plus cooks, drivers and handymen. The maximum number of students on courses at any one time is now 48, and the longest course runs for 28 weeks.

ORGANISATION OF THE COLLEGE

The organisation of the college is illustrated in Fig. 2. The Principal is responsible to the Head of Technical Training at Crawley Court, the Headquarters of the Authority's Engineering Division, for all matters relating to the running of the College.

Training work falls into two broad groups, one concerned with broadcast and transmission subjects and the other dealing with the principles of electronics, digital electronics, logic circuits and microprocessors. There is also a small section concerned with training projects, including the distance learning projects, and there is an administrative section.

The Broadcast and Transmission Group consists of two senior lecturers, two lecturers and three laboratory technician-demonstrators. Their responsibility lies, as the name of the group suggest, in areas concerning the principles of operation, maintenance and fault finding on IBA transmitters, transposers and their associated equipment. Two laboratories exist to meet these training needs, one for television and one for radio.

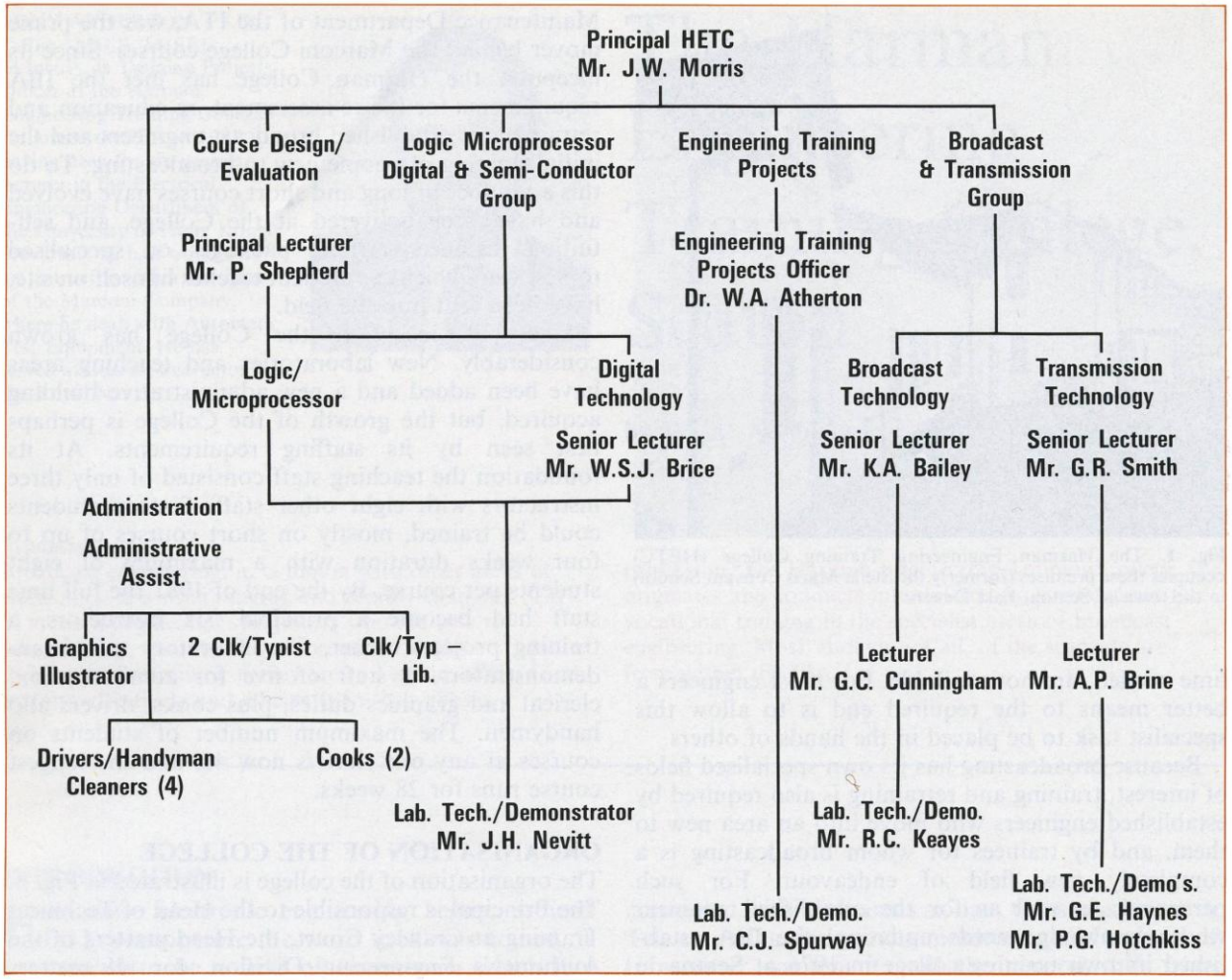

Fig. 2. Organisation of the Harman Engineering Training College (as at February 1982).

The Television Transmission Laboratory houses a sample of the major equipment currently used on station (Table 1) and is therefore able to offer training and instructional opportunities for most present day requirements. In addition it has a locally designed and built simulator for the Pye Phase 1 10 kW transmitter logic. However, it does not yet have any of the major items of equipment that will be used on the new fourth channel.

The Radio Transmission Laboratory, the newest laboratory, which will offer training opportunities on Independent Local Radio (ILR) equipment, is not yet equipped to the same standard as the TV Transmission Laboratory. However, it is expected that the laboratory will become fully equipped such that training will be available to the extent that the College would like. Table 2 lists the equipment presently available or expected in the near future.

The second group is the Digital Group whose responsibility covers the general area of digital electronics including the applications of microprocessors and the LSI semiconductor devices associated with them. Two of the lecturing staff and one technician make up the group, though other staff contribute from time to time. The Digital Laboratory contains a number of breadboard units and a wide selection of integrated circuits covering the main logic families used in IBA equipment, including TTL, ECL, NMOS and CMOS. There is also a Computer Room which, ultimately, will have four teaching areas, each with a microcomputer. Three microcomputers are now installed, an Apple II, a Nascom II and an

TABLE 1: TELEVISION TRANSMISSION LABORATORY

MAJOR ITEMS OF EQUIPMENT
Pye Phase 1 TV Drive Unit, UHF Bands IV/V with Marconi 6.25 kW klystron amplifier and power supply cabinet.
Pye 200 V Transposer, with alternative solid state penultimate amplifier.
LGT dual 50V Transposer.
Plessey 200V Transposer.
LGT 2S low power Transposer.
CML 10S low power Transposer.
STC dual VHF Transposer, with dual Marconi 10 watt amplifier.
Phase 1 Programme Input Equipment (PIE).
Simulator for Pye Phase 1 Transmitter logic, locally built.

TABLE 2: ILR TRANSMISSION LABORATORY

MAJOR ITEMS OF EQUIPMENT
Marconi dual 1 kW MF Transmitter, Phase 1 ILR.
Redifon BT500D 500 watt MF Transmitter, Phase 2 ILR (on loan).
MF Programme Input Rack, incomplete (on loan).
Marconi VHF Transmitter and Programme Input Rack (expected).

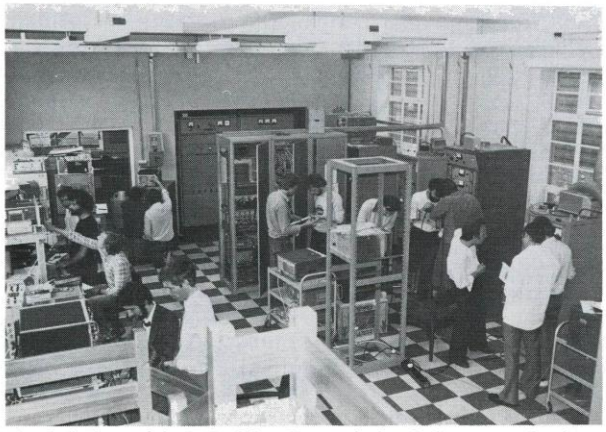

Fig. 3. A view of the Television Transmission Laboratory. Students are receiving instruction in the operation and maintenance of equipment actually used operationally at transmitting stations.

Fig. 4. The Radio Transmission Laboratory is equipped with VHF and MF transmitters typical of those to be found at ILR Stations. The photograph shows a 1+1 kW Marconi Valved MF transmitter on the left and on the right a Redifon 500 w all solid state MF transmitter with its associated Programme Input Equipment.

Intertec Superbrain. All have disc drives and use CP/M as a common operating system. As well as serving as tools for the College staff, the computers will be used for software training as computer

TABLE 3: REMOTE TRAINING PACKAGES

Station Digital Kit, for logic circuit construction. (Issued)
Microprocessor Training Kit, Motorola M6800 D2. (Issued)
Apple II Microcomputer, for high-level program language experience. (Issued)
Intel 8085 based Microprocessor Board, for further microprocessor experience, introduction to signature analysis, and with 'personality boards' to simulate various digital equipments. (To be issued)
Zilog Z80 based Microprocessor Board, as for 8085 board. (To be issued)

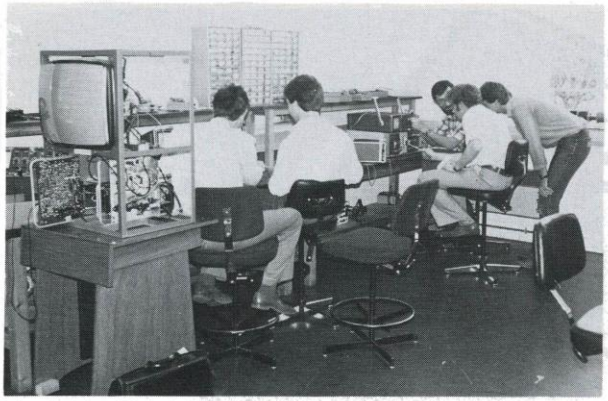

Fig. 5. The Digital Laboratory is well equipped with breadboard units and a range of integrated circuits covering the main logic families used within the IBA.

equipment using high-level languages is introduced by the IBA.

In addition to the above mentioned laboratories there is a Measurements Laboratory for television work. Typical test signals can be distributed to the work benches from a central rack. To a certain extent the Measurements and the Digital Laboratories are dual purpose and are used according to the requirements of the courses running at any given time. Generally speaking all the laboratories are well equipped with the necessary test equipment such as signal generators and analysers, oscilloscopes etc., and new items are added as technology changes.

Some subjects can be effectively taught at a distance and provisions have been made to send training packages to the stations where they can be used, more or less, as self-paced, self-tuition, short courses. These are especially useful where, because of other commitments, students cannot attend the College for lengthy periods. The success of such distance learning packages, as they have come to be called, depends as much on the motivation of the student, and the time he has available for study, as it does on the skill of the instructors who designed the package. Table 3 lists the distance learning packages that have so far been produced or are at the design stage.

Fig. 7. Measurements are carried out in the laboratories using test equipment similar to that in daily use at the Authority's transmitting stations.

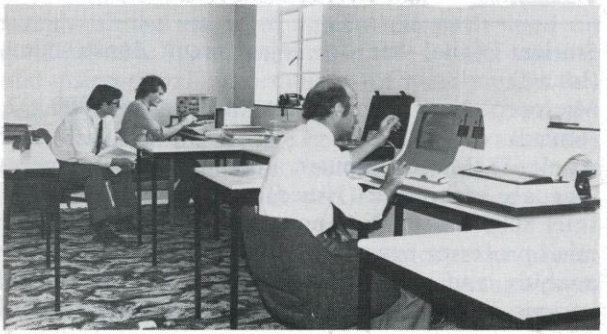

Fig. 6. Instruction on the use of microcomputers in the HETC computing room. Here an Apple II and Intertec Superbrain are in use. Eventually there will be four teaching areas each with its own microcomputer.

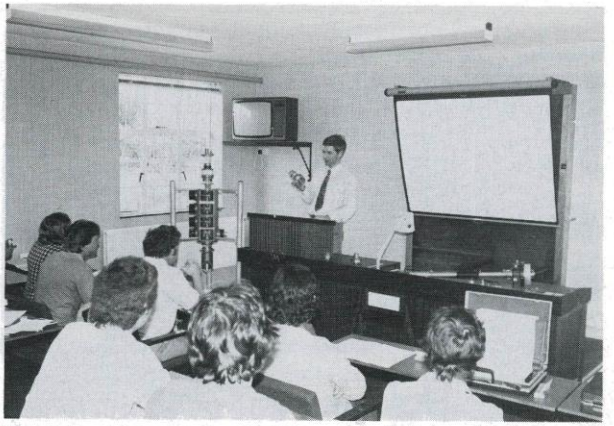

Fig. 8. Lectures are given in purpose built lecture theatres well equipped with audio and visual aids. A lecture on thermionic devices is being illustrated with the devices used at transmitting stations as examples.

The administration section of the College covers everything from the provision of catering and local transport, to performing all the clerical and personnel work. One of its major functions is to support the teaching staff in the production of the extensive documentation used with the courses, such as course notes, handbooks, diagrams and so on. A powerful word processor and extensive photocopying facilities are vital items of equipment. At some future stage the word processor may be linked to the computer room.

COURSES

Over the past few years a large number of courses have been conducted by the College staff and some of the older courses are no longer required. The teaching methods used may vary from course to course but can include lectures, demonstrations, laboratory work, discussions, seminars and projects requiring individual design work. Each student's progress is carefully monitored by the continual assessment method though formal examinations are also used on the Diploma courses. Laboratory work is a large and vital part of every course and on the Diploma courses it is monitored by examination of laboratory log books and formal reports. The detailed equipment courses are of particular value to established engineers as they enable students to examine simulated fault conditions without the pressing need to return equipment to normal operating conditions in the shortest possible time.

Details are now given of the courses presently available. Broadly speaking they fall into three categories: those which lead to a Diploma in Broadcast Technology, those which cover a specific subject of interest, and those which give detailed training on specific items of equipment. Further details of individual courses are available from the College.

Diploma in Broadcast Technology

This is a three-part course, conducted jointly with the Newcastle upon Tyne Polytechnic, and it leads to a Diploma in Broadcast Technology awarded by the Polytechnic. The series aims to provide Trainee Broadcast Engineers (TBEs) with the skills required to operate and maintain the IBA radio and television transmitters to the exacting standards required by the Authority. A maximum of 24 students can be accommodated on each section of the overall course. Their backgrounds will vary but they will usually have industrial experience as well as an educational qualification in electronics, such as a Degree, HNC, HND or City and Guilds FTC. Including practical training on station the overall training programme occupies 79 weeks as follows:

Induction Course at HETC	9 weeks
Station Training	3 weeks
Broadcast Engineering Course at the Polytechnic	27 weeks
Station Training	5 weeks
Transmission Technology Course at HETC	28 weeks
Station Training	7 weeks
	79 weeks

To obtain a Polytechnic Diploma a student must pass all three of the courses. All the examinations are moderated by the same external moderator who is a consultant electronics engineer.

An outline of these three courses is now given.

TBE INDUCTION COURSE. This nine-week course covers a wide subject area at an introductory level sufficient to familiarise the newly recruited students with the terminology and technology of broadcasting. Some subjects, however, including maintenance skills and the television signal, are covered in greater detail. The course is divided into three sections: general subjects, basic television and radio, and television studio techniques; roughly in the ratio 2 : 4 : 1.

TBE BROADCAST ENGINEERING COURSE. A 27-week course conducted by the Department of Electrical Engineering and Physical Electronics of the Newcastle upon Tyne Polytechnic, this course covers the essentials of basic circuit theory, signal theory, electronic devices and circuits, and the principles of sound and television broadcasting. Digital circuits and systems and electromagnetic propagation are also covered. The course is divided between lectures, seminars and laboratory work approximately in the ratio 2 : 1 : 1.

TBE TRANSMISSION TECHNOLOGY COURSE. The second HETC based course of the Polytechnic Diploma series expands on the introduction given in the Induction Course and introduces the student to the specialised aspects and applications of electronics met in broadcasting. For some specialised subjects visiting lecturers from within the Authority supplement the College staff. This 28-week course includes topics

such as measurements, programme input equipment, transmitters and transposers, regional control and automatic monitoring equipment, aerial and feeder systems, and digital systems. The transmitter and transposer sections occupy nearly half of the course.

Short Courses

INTRODUCTION TO BROADCASTING TECHNOLOGY. A three-week course to introduce the specialised aspect and applications of electronics used in broadcasting, this covers a wide range of topics all of which are related to the general field of television engineering. Originally the course was intended for recently graduated engineers new to the Authority, but in its present form it is suitable for students with a semi-engineering background or for Headquarters staff who, though expert in their own field, wish to extend their experience to other areas of television engineering.

TV SIGNAL AND MEASUREMENT TECHNIQUES (MOD). A two-week course for the British Forces Broadcasting Service, this provides an extensive introduction to the various aspects of the television signal and explains the operation and use of the appropriate test equipment, such as the spectrum analyser, standard demodulators, sweep generators and so on.

BROADCASTING AND MEASUREMENT TECHNIQUES. A five-week course for relative newcomers to the Station Design and Construction Department of the IBA, covers the theoretical and practical engineering of television systems together with the use of the various items of test equipment required to operate and maintain it.

MEASUREMENT TECHNIQUES. This two-week course covers all of the r.f., digital and video measurements required by staff involved in the installation and maintenance of a television transmission system. The students will usually be engineers from Transmitting Stations and Maintenance Bases although the course could be useful to engineers within other engineering departments who, as part of their general duties, are required to make measurements on a television system.

TRANSPOSER STATION SYSTEM. This three-week course is designed to act as revision for engineers who have completed earlier training on UHF transposers or who have gained experience in the field. As well as the various transposers used by the IBA their associated equipment is also covered; such as the telemetry equipment E194 control unit, Telecode, Teleshift and the EDAU equipments. The students are engineers from Transmitting Stations and Maintenance Bases.

PYE PHASE 1 STATION SYSTEM. A three-week course to familiarise students with the detailed circuitry and system design of the Pye Phase 1 transmitting equipment; the course offers an opportunity to engineers who normally operate or maintain transmitters of this type to examine simulated faults without severe time restraints. The course includes a refresher on measurement techniques.

LGT TRANSPOSER & AUTOMATIC SWITCHING UNIT. A two-week course covering all the currently used types of LGT transposers and amplifiers and the LGT Automatic Switching Unit; the course is aimed at engineers who may have to service, maintain and fault find on the LGT equipment. An appreciation of the associated telemetry is included.

PYE/TRT TRANSPOSER & CONTROL SYSTEM. This one-week course for engineers who may have to service maintain and fault find on MkI and MkII Pye 200V transposers and the associated control system includes an appreciation of the associated telemetry.

PLESSEY TRANSPOSER (200V) & CONTROL SYSTEM. This is a one-week course for engineers who may have to service, maintain and fault find on the PVS 490 Transposer. This transposer consists of two PT478 Transposers and a PV483 Combiner. However, practical work is restricted to the PT478 as this is the only item held by the College.

AUTOMATIC MONITORING EQUIPMENT & ROC AME TELEDAC INTERFACE SYSTEMS. Lasting three weeks, the course covers the practical and theoretical aspects relating to the Automatic Video Performance Measurement and Executive Control of the main IBA television stations, including both Programme Injection Point (PIP) and non-PIP sites. Equipments covered include the Marconi Instruments Signal Analyser TF 2914, the Marconi Instruments Data Monitor TF 2915, and the IBA Executive Interface System E362/2. The course is offered to senior station engineering staff and to appropriate headquarters staff.

SENIOR STAFF DIGITAL APPRECIATION. This six-day course is aimed at familiarising senior management staff with the recent dynamic progress of digital microelectronics. Though the time spent at the College is sufficient only to give a good introduction to digital microelectronics the detailed documentation given with the course provides an opportunity for further study if required. At least half of the time is spent in the Digital Laboratory.

DIGITAL DIAGNOSTIC TECHNIQUES. This is a five-day course for engineering managers. As digital and computing techniques invade the IBA Transmitter network it becomes increasingly necessary for the engineering managements, as well as the operational engineers, to understand those techniques which are new to broadcasting. This course offers instruction on microcomputer systems, signature analysis and other microcomputer fault finding techniques, as well as the production and maintenance of software. It also introduces the microprocessor fault finding training package.

DIGITAL AND MICROPROCESSOR SYSTEMS. A more detailed three-week course on digital microelectronics and microprocessors, is this time aimed at engineers. As with the shorter courses only an appreciation of digital concepts can be given in the time available. However, the extensive course documentation gives a fairly detailed treatment of each subject and enables a start to be made on further study into any of the topics after completion of the course. Work is directed towards four main subject areas: basic logic circuitry and applications, Teletext, Digital Television and Microprocessor systems. At least half of the course is held in the digital laboratory and a considerable effort is made to give practical experience with microprocessor systems using the College Motorola M6800 D2 kits and other microprocessor systems.

ADVANCES SOFTWARE TECHNIQUES. A three-week course is proposed for transmitter Systems Engineers who will have to liaise with software maintenance engineers for work on the Fourth Channel. The course will familiarise the students with programming concepts, the production and maintenance of software, and with high-level languages such as BASIC, PASCAL and PL/M.

REMOTE TRAINING PROJECTS

The remote training or distance learning projects are a fairly recent type of instruction to be introduced by the College. They have been introduced to enable as many engineers as possible to gain some experience of modern digital electronics and its associated software without those engineers having to leave their station. The training projects are to be used as self-paced, self-instruction packages and come complete with the necessary literature, hardware and software. They are meant to be used either on site or at home. In some cases the literature is retained by individuals when the hardware is passed on to the next user, each engineer having his own set of documentation. Also, for some projects, a phone-in 'clinic' is operated by the College.

A detailed description of these remote training packages is contained in 'Digital Techniques and Microprocessors in Broadcasting' by A. W. Reading elsewhere in this *Technical Review*.

INFORMAL TRAINING

As well as the formal coursework training, the College has offered training opportunities in other ways. In addition to the distance learning packages the most important of these have been:

(*a*) Opportunities for engineers from the Station Operations and Maintenance Department to spend a few days or weeks in the College laboratories, more or less as private students. A tutor is assigned and a project undertaken.

(*b*) Works experience for sixth formers from local schools.

(*c*) Contributions to the Government Youth Opportunities Programme.

DEVELOPMENT WORK

In a training environment it is sometimes desirable to modify the behaviour of items of equipment in some way so as to demonstrate a problem to a student. This can be particularly useful when examining the effects of faulty equipment or when practice is required at fault finding. While it is possible to deliberately introduce faults into equipment for such reasons it is not usually good practice. It can lead to other unexpected faults or, over a period of time, the physical location of the fault can become obvious at a casual glance from the wear-and-tear aspects of repeatedly introducing and repairing the fault. A better way, where applicable, is to introduce simulated faults.

Part of the work at the College has been to develop a number of hardware and software items which act

as equipment simulators. As well as being available for introducing simulated faults they are also very useful in providing simulated signals at the input of items of equipment so as to make that equipment appear to be working under normal, as well as abnormal, operating conditions. In this way equipment designed for an operational role can be used very effectively in a training role. Such College built simulators range in size from a small rack of equipment to a single board. Other development work has centred on designing and building the remote training packages, especially those associated with microprocessor training.

A selection of the development work is outlined below.

Pye Phase 1 10 kW Transmitter Logic Simulator
This is an integrated circuit mock up of the discrete component logic of the transmitter and is electrically equivalent to the Pye system. In addition the simulator can supply simulated transmitter fault warning signals to the logic circuitry and can also introduce fault conditions into the logic circuitry itself. It may be used on any course involving the Pye Phase 1 10 kW transmitter logic and it is hoped that eventually it will be interfaced with the PIE/Teledac system.

Transmitter Logic Signal Simulator
This unit can supply a small number of transmitter indicator/alarm signals to the Automatic Control Unit type E141 of the Phase 1 Programme Input Equipment (PIE) bay.

Telesim
This simulator, which uses a Motorola 6802 microprocessor, simulates all the request and command signals which can be sent from a Regional Operations Centre via the Teledac Telemetry System to the PIE bay of a Pye Phase 1 Transmitter system. It will also accept and display the returning information. Telesim is a powerful unit which enables training exercises to take place as if the Teledac communication and control telemetry system was actually in use. It gives a good demonstration of the power of microprocessors and has enabled College staff to gain useful experience in designing with microprocessors. Changes in use are effected by fairly simple software changes.

AME Simulator Units
The Automatic Monitoring Equipment (AME) contains two instruments: a TF2914 Signal Analyser and a TF 2915 Data Monitor. Simulators have been built for each instrument. This enables the two instruments, which normally operate together, to be separated and used with the other simulator. Two groups of students can therefore be trained at the same time. Also, individual simulators have been built to demonstrate important actions of the Data Monitor.

Telecode Exchange
A two-digit telephone exchange which illustrates the Telecode Master and Slave call up and data exchange. The mark space ratio of the data can also be displayed.

M6800 D2 Kit
The basic Motorola microprocessor development kit was modified for the remote training project by providing an accessible, socketed, peripheral interface adaptor with a buffered LED readout, a permanently connected cassette recorder for bulk storage of data, and a zero-force system expansion connector. The whole system is packaged in an attache case. Construction of the units was contracted out to Omni Data Products Ltd.

Microprocessor Boards
Three microprocessor printed circuit assemblies have been developed featuring the 6802, 8085 and Z80 microprocessors. Design and assembly has taken place at the College. The 8085 and Z80 boards are for use with 'Personality' cards in the microprocessor fault finding remote training package. The personality cards, which condition the microprocessor boards to act like established items of hardware, are also designed and built at the College. The 6802 board is for internal use in dedicated applications as an aid to the teaching of digital test equipment, as in Telesim for example.

Microcomputer Software
In conjunction with the establishment of a computer room with four different microcomputers, it is necessary to develop a considerable amount of high-level and machine code programs. Some of these are to enable the exchange of data between the four machines and also to enable them to share expensive equipment such as a printer. Other programs are to be developed to aid in the training of engineers who have to use computers programmed in high-level languages. The Regional Operations Centres already

have Ferranti Argus computers and other computers will follow the Argus into IBA use. It will become increasingly necessary for IBA broadcast engineers to become competent users. The College also expects to develop training programs for use on the Apple II microcomputers already distributed to stations.

THE FUTURE

Where to in the future? It is not too difficult to predict that the General Purpose Interface Bus will be found in our systems in increasing numbers, together with second generation 8-bit and 16-bit microprocessors and their support devices which will be used in advanced adaptive and programmable transmission equipment interfaces and telemetry control systems. Digital television is already present in many laboratory and studio environments and this will undoubtedly, with the increasing speed of microprocessors and general logic systems, develop to the stage where digital television at radio frequencies will be possible.

The IBA has made a firm and well intentioned commitment to the introduction of formal training in microprocessor and digital systems. The nature of digital technology is changing rapidly to the extent that systems orientation is a more significant factor than the understanding of device details. HETC will continue to strive to meet the new training needs that changing technology demands.

CONCLUSIONS

The Harman Engineering Training College was established in 1976 as a natural development of previous in-house and external training efforts by the engineering sections of the IBA. Its facilities, which include lecture rooms, laboratories, workshops and clerical facilities, are used to offer a variety of courses covering most of the broadcast engineering training requirements of the Authority. In addition a start has been made on self-paced, self-tuition, remote training packages for use on station. The College laboratories contain a wide selection of hardware in the fields of broadcast technology, transmission equipment, and digital microelectronics; and where necessary these are supported by College built equipment simulators.

Acknowledgement

The Author acknowledges with thanks the help given in the preparation of this paper by other members of the staff of the Harman Engineering Training College. Certain parts of this paper have been extracted, with modifications, from college documentation.

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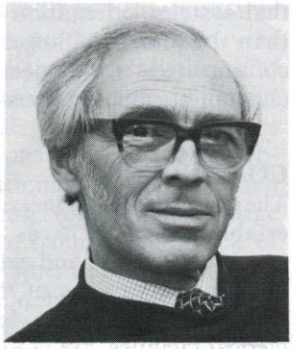


Broadcast Television Training at Leeds Polytechnic

by D. Leahy

Synopsis
The School of Electrical Engineering within Leeds Polytechnic provides several short duration training courses for broadcast television engineers. This article describes how, from small beginnings, these courses have developed into major items of the School curriculum. Important items of equipment have been acquired from the IBA, and from several programme companies and manufacturing organisations. These, together with a judicious re-investment of short course income, have enabled the School to provide significant laboratory facilities for short course training.

INTRODUCTION

Since mid-1974 the School of Electrical Engineering within Leeds Polytechnic has provided an unbroken sequence of intensive training courses for broadcast television engineers. By the end of September 1981 a total of 80 such courses, each of one week or two weeks duration, had been held; these had been attended by some 1,250 engineers. The courses dealt with digital electronic circuits and techniques, microprocessor programming and applications, the principles and practice of current television techniques, and the concepts of digital television systems. This work has earned the School a high reputation for engineering training among personnel of the Independent Broadcasting Authority, most of the Independent Television companies in the UK, the British Forces Broadcasting Service and companies in Scandinavia, Europe, Africa and the Middle East.

The range of training courses was expanded as new needs emerged and as resources became available. The initial expansion was slow as it was not funded directly from central Polytechnic resources. Rather, it relied heavily on the careful re-investment of short course income to provide a resource base from which established courses could be sustained and new courses could be launched.

A major objective of all courses has been to enable participants to acquire a greater competence and confidence to work on television engineering. To this end the staff have endeavoured to offer a professional standard of training at all times, to respond constructively to comment on the effectiveness of the training, and to cultivate that sense of co-operation between the course members and the teaching team which is so essential to an all-prevading *esprit de corps*.

HISTORICAL BACKGROUND

Two major influences on the provision of training courses for broadcast television were, firstly, the changeover to colour broadcasting, and secondly, the introduction of digitally oriented equipment into television studio and transmitter practice.

In September 1968 the newly formed Yorkshire Television Company acquainted the then Leeds College of Technology with the problems of 'going colour to a date'. The School responded to this urgent need for staff training in colour television techniques by developing a three-week course entitled 'The Principles of Colour Television'. This course ran during the period 1969-70 and was well supported by Yorkshire and Granada Television and by most of the northern companies. However, as Independent Television began to solve its own problems of colour transmission, the need for the course declined even though 350 copies of the course notes were sold after the formal closure of the course. Nevertheless, the experience gained at that time, in planning and running a short-duration course for industry, was later to prove invaluable.

It was foreseen that training in digital electronics would be the next requirement; some monitoring field work indicated that the demand could be substantial. However, it was the request from Yorkshire Television, for talks on their need to prepare staff for the imminent introduction of digitally oriented studio equipment, which provided the impetus to develop a new course.

By that time the School had recruited some new staff and was ready to meet the challenge and the subsequent discussions led to the development of a two week course entitled 'Digital Electronics for Television Engineers'. Yorkshire Television made an advance payment on half the places for the first three courses and Granada Television took an interest in the rest. The first of these DTV courses was launched in April 1974 for engineers from both the sponsoring programme companies.

At that time no-one expected this series of courses to be sustained for more than about one year. However, at least three DTV courses have been held in each year since 1974, and that held in September 1981 was the forty-sixth of the series, including those especially commissioned by the IBA (see Fig. 1). Inevitably, the course has undergone some changes as a result of experience gained and of further developments in technology. These relatively minor changes reflect well on the initial course planning. The training offered met the needs of the industry, both at company management level and at that of the engineers who attended. Early assent to this provided the School with the incentive to expand the range of training offered.

THE DTV PHILOSOPHY AND COURSE FORMAT

The principle adopted from the outset in 1974, was to offer a course covering fundamental digital concepts, circuits and techniques. This would enable operations and maintenance staff to handle digitally oriented equipments with greater competence and confidence. It was also to provide the necessary technological background for specific equipment courses offered by the commercial manufacturers. However, there was never any intention that these latter highly specialised courses should be replaced by Polytechnic short courses which must always concentrate on the broader principles involved.

The course format adopted for DTV was of two week full-time duration. Each morning session would be devoted to lectures on essential principles and techniques, while most afternoon sessions would involve practical exercises in the laboratory (Fig. 2). The provision of practical experience with digital devices and systems would enable the engineers to evaluate their understanding of the essential principles, to apply these principles to a series of graded design exercises and, at a later stage, to undertake a mini-project appropriate to some aspect of television.

Within this framework the philosophy of 'learning by doing' could readily be applied. However, since that is a relatively slow process, more laboratory time was provided by offering an optional early evening session on most days of the course. This latter facility has been well received by most engineers and is especially convenient for those who stay in local hotel accommodation during the course.

The theoretical content of lectures was designed to be essentially non-mathematical, and device physics was reduced to the minimum necessary to the smooth progress of the course. Thus, the major emphasis of lectures was directed towards discussing the types of device available, their limitations and handling requirements, techniques for minimising problems of timing and of synchronisation, and general application. The TTL data book soon became an essential reference for the course.

It is not easy to provide adequate training, in the skills of digital fault finding, for maintenance

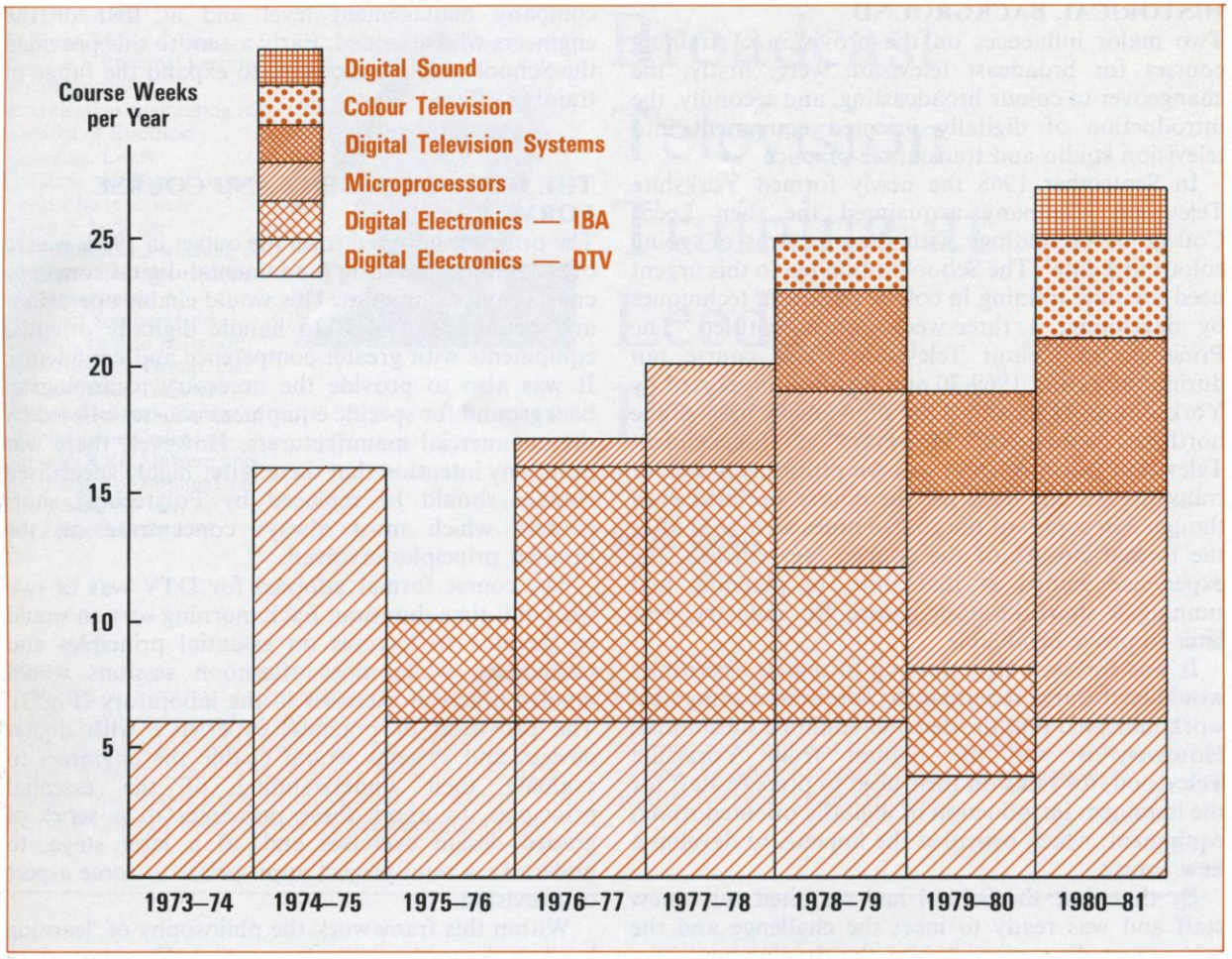


Fig. 1. The growth and development of short courses at Leeds Polytechnic.

engineers who are largely unfamiliar with digital techniques. While exercises could be devised using systems which incorporate deliberate faults the problem then becomes one of suitably specifying the correct system behaviour. However, when practical design work is an integral feature of the course, system malfunctions will inevitably occur. Because the engineer concerned is intimately involved in the system from design concept to hardware implementations, the elimination of malfunctions can provide a wide range of fault finding practice. Malfunctions can arise from an incorrect design concept, from misreading of the data on device operation, from use of a faulty device, from misuse of a sound device or from use of faulty test equipment.

The balance of lecture content, tutorial material and laboratory exercises, was chosen to meet the needs of design and development staff, and those concerned with operations and maintenance. During laboratory sessions participants are encouraged to start from a point consistent with their current experience so that their personal 'learning by doing' can be as efficient and effective as possible.

DEVELOPMENT OF RESOURCES

Various resources were needed prior to the first DTV course. These included a set of well prepared course notes covering both lecture material and laboratory exercises, a lecture room with suitable audio-visual

Fig. 2. The early days of DTV—A project involving the use of character generator ICs to write messages onto a TV monitor has been successfully completed—a moment to relish—with obvious satisfaction. The need for a purpose designed breadboard system for the implementation of digital circuits is clearly demonstrated.

aids, demonstration material, and a specially commissioned laboratory. The latter further required an adequate stock of digital breadboarding systems, digital ICs, relevant data books and items of test equipment.

Financial assistance from Yorkshire Television enabled the Polytechnic to fund advance purchasing of digital ICs, data books and commercial breadboards. Items of test equipment were borrowed from the provision for the degree and diploma courses run by the School.

Some lecture topics were to be covered by specialist visiting lecturers. However, to enable the DTV teaching team to devote adequate time to course preparation, and its teaching, other members of staff undertook extra teaching duties with the regular Polytechnic courses. Thus, the School embarked on its new venture in a mood of great optimism and co-operation

These early courses ran remarkably smoothly and, in a surprisingly short time, the good news of the DTV course at Leeds spread to other television companies. Course recruitment, and the number of companies involved, increased steadily so that, by mid-1975, it was already apparent that the DTV series could have a much longer life than had been envisaged. This growth of interest naturally led to increased receipts. The prospect of being permanently solvent meant that money could be used for re-investment. Since it had been agreed from the outset to keep staff payments to an absolute minimum, virtually all this residual income was directed towards a steady improvement of the laboratory facilities. It was also foreseen, for the first time, that short courses could become a permanent feature of the School curriculum.

DIGITAL ELECTRONICS FOR THE IBA

From early in the series the IBA had provided a steady number of recruits to the DTV course. During 1975 the IBA reviewed the training requirements of their engineers, particularly of field engineers, in the light of developments in digital technology and its impact on the future organisation of the IBA transmitter stations. Opinions about the DTV course at Leeds were sought from about 30 engineers who had attended by that time; and, subsequent developments would suggest that comments were generally favourable.

In June 1975 the IBA asked if the School could give training in digital techniques to about 180 field engineers, the course to be of format similar to that of DTV but with modifications to meet special needs of the IBA. It was envisaged that this training programme would take about three years to complete. This was clearly too good an opportunity to miss and the School reacted promptly and positively. Negotiations with the IBA training department and senior engineering staff began immediately. These culminated in the first of the IBA Digital Electronic Courses. It was held in February 1976 and was the beginning of a very happy and fruitful association between the School and the IBA training department staff.

This development was of tremendous importance to Leeds Polytechnic and remains so. Firstly, the request itself was a morale booster to the School staff who worked so hard to get short courses established; secondly, the negotiated agreement to run a specially commissioned course for the IBA was sufficiently contractual in nature, the time span sufficiently long, and the potential income sufficiently large, for it to be used persuasively in discussions with higher authorities outside the School. Short courses had become firmly established, and all future planning for the School would need to take due account of this.

One important development was the local education authority's approval for a temporary lectureship, of three years duration and funded directly from short course income. Many subsequent short course developments can be traced to this additional staff appointment, which has since been made permanent.

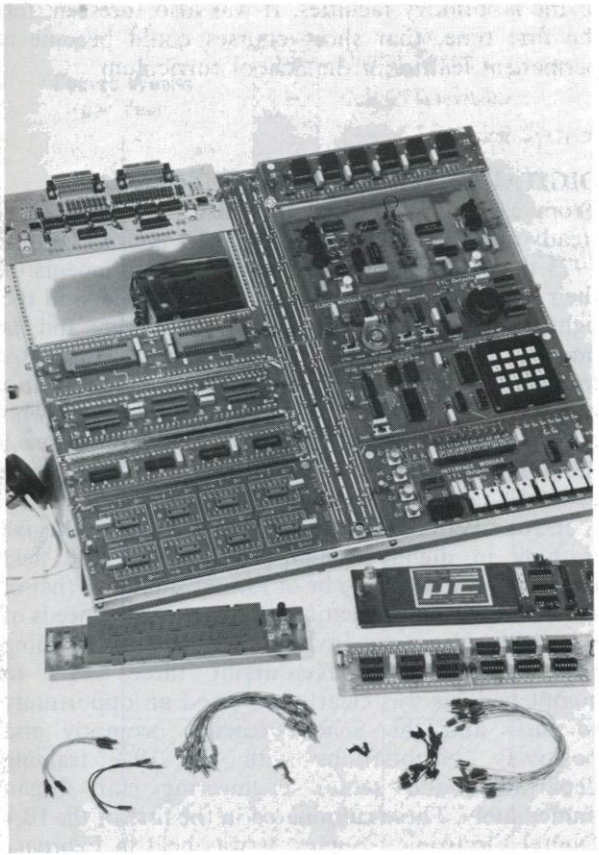


Fig. 3. The purpose designed breadboard system and a range of modules which facilitates compact system layout, with minimum lead lengths, is shown. A range of special functions modules is added to as new needs arise and these can be readily incorporated into the basic system.

The IBA agreement provided finance for a significant expansion of the laboratory facilities for digital electronics, and for ensuring the commissioning of a dedicated short course lecture room within the School. To some extent the subsequent development of certain major interests in microprocessors and advanced television techniques could be attributed to that important agreement.

The necessity of matching the new course to the particular needs of the IBA afforded a splendid opportunity to review critically the original DTV course which had been designed to meet the needs of the studio companies. After completing negotiations with the IBA it became apparent that the major outcome was a course update consistent with recent developments in technology. In its revised form the course would also more than satisfy the requirements of studio engineers. Thus, from early 1976 to mid-1980, the digital electronics course was offered under the dual guise of the IBA course and the DTV course. During that time the IBA course ran seventeen times and was attended by 276 IBA engineers and 31 engineers from other companies. The DTV course ran thirteen times and was attended by 220 engineers. Viewed from any standpoint this period represented a significant contribution to engineer training.

Although some revisions of course contents and presentation took place in 1976, the fundamental philosophies adopted in 1974 remained unchanged. The success of short course training at Leeds owes much to the concept of 'learning by doing'.

NEW DIGITAL BREADBOARDS

The breadboarding systems purchased at the start of the DTV course were quite adequate at a time when most of the digital ICs used were in 14 DIL or 16 DIL packages. However, as developments in MSI technology led to the introduction of many important devices in packages exceeding 16 pins, the breadboards became less convenient to use. Timing problems, and speed limitations, arose from the use of long connecting leads. Furthermore, by 1977, new courses concerned with high speed digital applications, and with microprocessors, were being considered. Thus, a decision was taken to invest in new breadboarding systems. A survey of the market showed that suitable alternatives were not available commercially at acceptable prices.

It was agreed that the School should produce its own breadboarding systems to the professional standard required. The initial breadboard design was prototyped by staff of the School. It involves a simple mechanical framework incorporating a central bus-bar arrangement for power distribution and upon which can be mounted a number of specially designed printed circuit board (pcb) modules (Fig. 3).

Professional standard cage-jacks and leads are used for all circuit interconnections and the modules are readily interchangeable within the framework. These arrangements facilitate optimum circuit design and layout, and minimise the lengths of interconnecting leads.

The initial range of modules included: arrays of DIL sockets of various size for mounting the ICs needed in system design; a clock source which can be crystal controlled, and varied continuously from 1 Hz to 10 MHz, or single stepped; an interface module

Fig. 4. The current microprocessor facility based on the Motorola 6800 development system incorporating an interactive editor–assembler. The system has been further developed to include a facility for programming in BASIC. Program storage is provided via a cassette recorder and the system is readily interfaced to a digital breadboard or other peripheral hardware units.

providing buffered switch outputs and/or buffered LED displays; TTL-to-CMOS and CMOS-to-TTL interfacing; buffered 4-bit or 8-bit word drives from a hexadecimal keyboard; and a module incorporating several hexadecimal display units.

The final breadboard systems used in the short course laboratory were manufactured by second year Higher National Diploma students of the School during their workshop training course. During the final phase of this training each student was expected to make at least one main-frame and a set of the standard modules. The project was funded from short course income and, by January 1978, fifteen fully evaluated breadboard systems were available. The venture represented money well invested and valuable workshop practice for the HND students. It affords one example of the benefits that accrue from integrating short courses into the teaching role of the School. The production of breadboards was repeated successfully in the autumn of 1979 thereby increasing the general stock of the new systems throughout the School. Apart from the occasional dry joint, the systems have proved very reliable and have met with general approval.

A number of important new breadboard modules had been added to the range by October 1981.

MICROPROCESSOR TRAINING COURSES

By late 1976, microprocessors had begun to make an impact on the work of the School and, encouraged by the success of the DTV courses, the School decided to launch a microprocessor training course for industry. This one-week course concentrated on the essentials of 6800 programming using manual assembly, input/output techniques, subroutines and interrupt facilities, but included some discussion of general computer architecture and comparison of other microprocessor systems. Laboratory exercises were based on the Motorola D1 evaluation kit.

The course was launched in May 1977 and proved very popular. It ran nineteen times and was attended by 270 engineers before being replaced in June 1979 by the current two-week course 'Microprocessor Programming and Applications'. A development system incorporating the Motorola 6800/2 and designed specifically for teaching purposes (Fig. 4) was built for use with the new course. This work was aided by a Government grant under the MAP scheme.

Very powerful support software was also developed within the Polytechnic. An interactive editor-assembler traps the majority of syntactical errors made by the programmer as statements are entered via a VDU, and informative diagnostic messages are given to facilitate immediate correction of errors. The operating system and monitor have been designed to enable the user to switch readily between the running program and the original source program so that run-time errors can be corrected as these occur. The monitor provides full facilities for tracing the running of a program. It can be single-stepped through each instruction, can give a continuous trace of all instructions, or can act as a 'window' on the state of the microprocessor as the program passes through certain pre-selected instructions. Cassette storage for

Fig. 5. A scene during a Digital Television Systems Course. The project has reached an advanced stage—but it is a very serious business. Deliberations are taking place on how to overcome the latest problem.

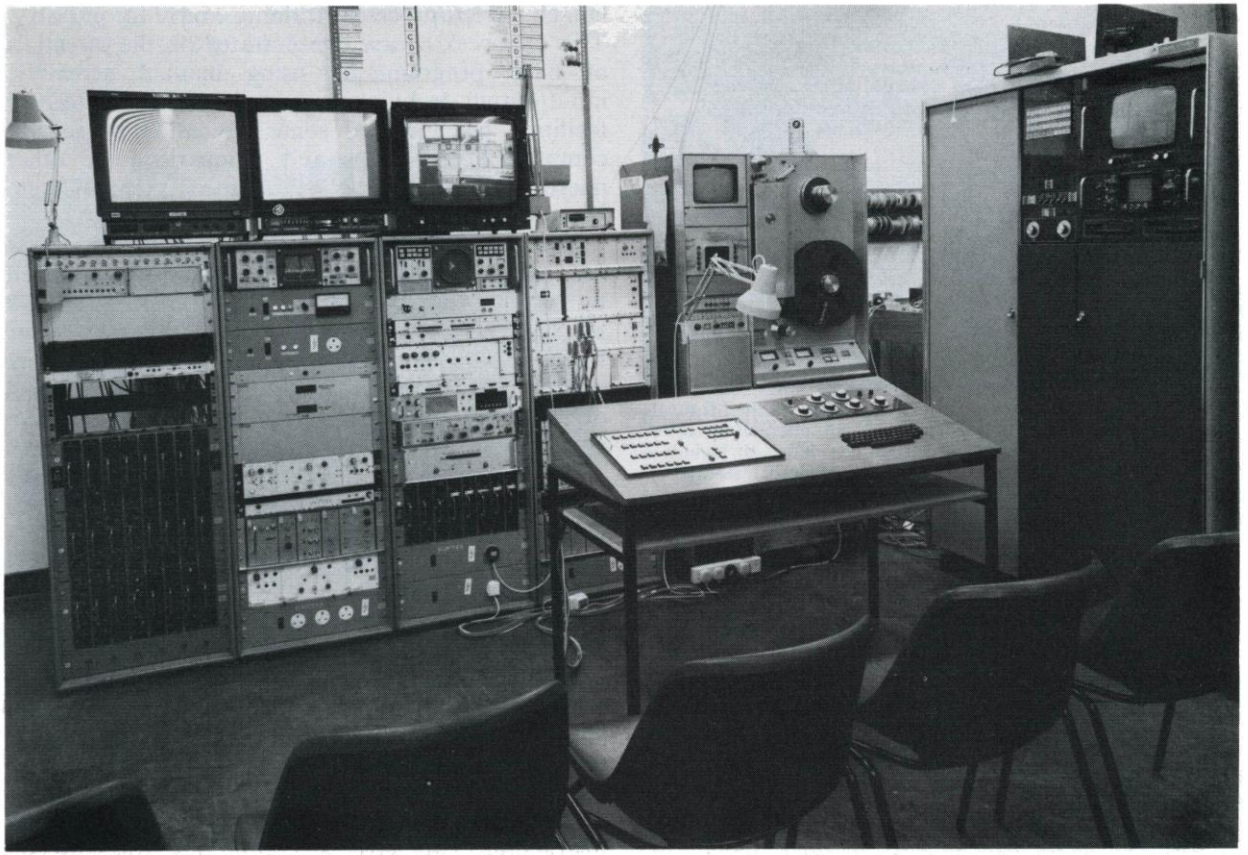


Fig. 6. A general view of the School's television laboratory. The racks contain test signal generators, vector and waveform monitoring, assignment switches and equipment for digital TV demonstrations. To the right of the view is a TR50 2″ VTR and a Cintel slide scanner. Mixing and Tariff facilities are also available. Picture monitors—high resolution and standard Barcos and illuminant D black-and-white are installed on the racks; these permit viewing for up to 20 students. Two Marconi VII cameras are located in the adjacent room. The right hand picture monitor shows a view of the laboratory using one of the cameras.

programs and data is provided and line printers can be used to obtain hard copy. A facility to programme in BASIC has since been incorporated into the development system.

Assembly language programming is a major feature of the course, and more than 60% of the course time is spent in the laboratory. Input/output techniques are considered early in the course to facilitate interfacing with actual hardware systems which can be implemented on breadboarding similar to that used in the digital electronics laboratory. Practical exercises during the first week cover all the essential programming and interfacing features of the 6800 system. During the second week, participants are encouraged to undertake one or more of a range of small projects or to suggest projects of their own (Fig. 5).

THE DIGITAL TELEVISION SYSTEMS COURSE

Many engineers from the broadcasting industry had expressed an interest in a course providing a more comprehensive treatment of digital techniques in contemporary television than was possible in the DTV course. Consequently, the two-week 'Digital Television Systems' course was designed to meet this need. Since January 1979 it has been held on eight occasions, and has been attended by nearly 100 engineers including many from overseas.

The course assumes a working understanding of the PAL television system, and knowledge of digital circuits, techniques and sub-systems comparable to that covered by the DTV course. The course starts with detailed discussion of the concepts of sampling in the television context. It then proceeds to consider

Fig. 7. A course project to investigate bit-rate reduction techniques has reached an advanced stage. Here the breadboarded system has been interfaced to the television laboratory.

digital filtering, fast arithmetic techniques, high speed codecs and data transmission systems. Important techniques discussed include those of bit-rate reduction.

Selected applications of these concepts are considered in the light of contemporary work in television broadcasting. These include telecine, VTR, frame stores, standards conversion, digital sound and teletext. Some of these topics are covered by specialist visiting lecturers.

More than half the course time is devoted to laboratory work (Fig. 6). From the outset, engineers are encouraged to make a major investigation into some aspect of television relevant to their specialist knowledge, or interest, but compatible with a two-week course. Many of the projects undertaken will take advantage of the specialist television laboratory which has been commissioned in the School. It has been developed as a comprehensive signal origination source with switched outputs to various terminals and includes much signal processing equipment. Thus it can be used either as a television project laboratory or for demonstrating the effects of bit-rate reduction (Fig. 7), aliasing etc. An electronic zone-plate generator is an important demonstration tool in the laboratory.

Much of the laboratory facility represents the hard labours of staff and a succession of final year undergraduate students who have undertaken television projects. Most of the major equipment items have been acquired, at little or no cost, from good friends in the IBA and the programme companies. These items include cameras, VTR, slide scanners, and a 'noise reducer'.

THE DIGITAL SOUND COURSE

This is a relatively new course, the second of which took place in October 1981. Basic concepts of digital circuits and techniques are dealt with in the first week using a syllabus identical with that of the first half of the DTV course for video engineers.

The second week is devoted to audio applications of digital techniques. It deals with the concepts of audio codecs, digital signal processing, sound synthesis, sound recording, audio PCM transmission systems and the application of microprocessor systems. Laboratory work is organised as a series of mini projects.

CURRENT TELEVISION TECHNIQUES COURSE

A two-week course entitled 'The Principles and Practice of Colour Television' has been run on three occasions. Originally it was designed to meet the needs of educational establishments and similar organisations having closed circuit television and/or television production units which were about to be changed to colour operation. At a later stage several broadcast companies recognised the potential of the course for training their new recruits. Even more recently Yorkshire Television, with support from other companies, has suggested the inclusion of ENG techniques.

Thus a revised course entitled 'Current Television Techniques', has been devised to cover television principles, the PAL system, essential principles and operation of studio equipment, production practice involving lighting and sound techniques, studio

Fig. 8. A student location crew using a JVC2700 camera and portable U-matic VTR as part of an exercise on the Current Techniques Course.

operations, videotape recording and ENG recording. The first such revised course was held in October 1981.

The Educational Technology Unit of the Polytechnic is a joint organiser of the course. The Unit, with which the School enjoys a very close liaison, has a colour TV studio equipped with colour telecine and three studio colour cameras. Recording and distribution is carried out on standard U-matic format and the editing facilities include an IVC 2002 timebase corrector, a VEL Tapecode edit controller and a 'twin-wheel' U-matic edit suite. For location work high quality portable cameras with modern circuitry are available (Fig. 8).

These facilities permit the preparation of a complete TV programme to be included in the course. One of the primary roles of the Unit is to produce videotape and other teaching aids. The production standards regularly achieved by the Educational Technology Unit have been the envy of many visitors to the Polytechnic (Fig. 9).

LINKS WITH THE BROADCASTING INDUSTRY

The Polytechnic maintains very effective links with the broadcasting industry. Such links have been established in various ways but, in particular, all staff appointed to teach in the School must have acquired appropriate industrial experience. Many of them undertake consultancy work for industry. Several staff have been seconded, for periods of about two months, to the IBA's development laboratories at Winchester. There they have joined project teams working on important contemporary developments in television, e.g. standards conversion frame stores and major microprocessor system applications. Many staff have established important contacts with the broadcasting industry through visiting sandwich course students on industrial placement.

Short courses provide an opportunity for a valuable exchange of ideas between the School staff, specialist visiting lecturers and the large number of engineers who attend these courses. Recruitment to these courses creates further opportunities for liaison between the School staff and senior managers and training officers within the industry. A strong delegation is sent biennially to the IBC because of the relevance of its technical papers and equipment demonstrations as well as the opportunities afforded for informal discussions with other delegates.

THE FUTURE TRAINING ROLE

Under the leadership of John Hutchinson, Head of the School of Electrical Engineering, a training resource of great significance to the broadcasting industry has been established at Leeds Polytechnic. The staff have been motivated to devise and implement a broad spectrum of short courses, the growth of which is shown in Fig. 1, to meet the continuing training needs of engineers. Already ideas for further new courses have been discussed with the training officer of the ITCA and other company representatives. The School is prepared to respond to any proposal from the industry likely to lead to yet closer co-operation.

Fig. 9. A simulated transmission of a news programme in colour showing vision engineering, telecine remote control and vision mixing desks.

Short-course work has helped to reshape the degree and diploma courses held at the School. Thereby future students will be even better equipped for employment within the industry.

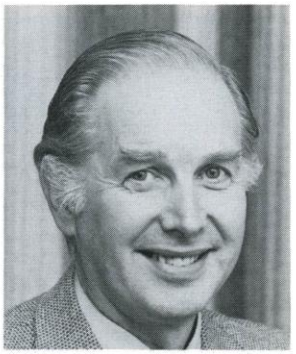
The staff of the School hope that, henceforth, the resource which has been described can be harnessed even more effectively, that the links with the broadcasting industry can be made yet stronger and that Leeds Polytechnic will long be renowned for the good engineering training it provides.

ACKNOWLEDGEMENTS

This opportunity to review the development of broadcast television training at Leeds Polytechnic has highlighted, for the author, that staff collaboration has been the major key to success. The article is dedicated to all the secretarial, technical and teaching staff who have contributed to the enterprise. In particular, the major contributions over many years of David Carey (now Technical Director of John Watson & Smith Ltd., Leeds), John Colan, Brian Mann and Paul Scorer are gratefully acknowledged.

Technical Training within Thames Television

by J. E. Tasker



JOHN TASKER was educated in Wales. Having studied Metallurgy he joined the RAF and served in Singapore. He later studied Music, English Literature and Philosophy. In 1956 he joined ABC Television as a sound trainee later becoming Head of Sound. Upon the formation of Thames Television he again headed the Sound Department and, in 1973, he was appointed Training Organiser. In 1977 he installed, to his own design, the Thames Training Centre, with studio, control room and teaching facilities. He serves on many committees concerned with Technology and Art, is a member of the Royal Television Society and a fellow of the BKSTS.

Synopsis

The training department of Thames Television was formally established about three years after the formation of Thames Television with the object of providing technical training to new recruits to the industry. Trainees undergo a one-year course, nine months of which are spent under the control of the training department, and which covers fundamental principles and practical training in various sections of the company.

Courses are also provided in other disciplines to those employed within the company including non-technical staff, and further technical courses cover such subjects as new equipment and digital technology. There is a considerable amount of liaison with other training institutions and professional bodies involved in the industry.

Thames Television was established thirteen years ago, and Thames Training Department began operating about three years later. In addition to courses of technical instruction, training is given in the subjects of programme production, sales, administration and business management development. A prime activity, however, continues to be the Thames Technical Training Scheme. In addition, there are technical courses on specific items of equipment, specialised techniques and developments such as digital principles. The training methods employed include classroom instruction, operational demonstrations, periods of training on attachments and programme production exercises.

The Thames Training Centre is at Teddington, Middlesex (Fig. 1). It consists of a small training studio with an up-to-date control room, a lecture room with a wide range of audio and video facilities, a study room, a library, and an administrative office.

The Training Studio complex employs a closed-circuit black-and-white television system rather than one of colour; but the control room, which can be operated very simply, has many modern in-built features. These include remote gen-lock, multi-track audio, time code and lighting control, and colour facilities which enable the simulating of ENG operation, including still-frame editing. This feature is used for demonstrating single-camera shooting as well as the assembling and editing techniques of programme production.

Figure 2 shows some of the equipment. The students who appear in this photograph are a group of broadcasting engineers from the Harman Engineering Training College of the IBA, whose training includes one week of instruction at Thames. The demonstration here shown is of broadcasting techniques as used by the Programme Companies.

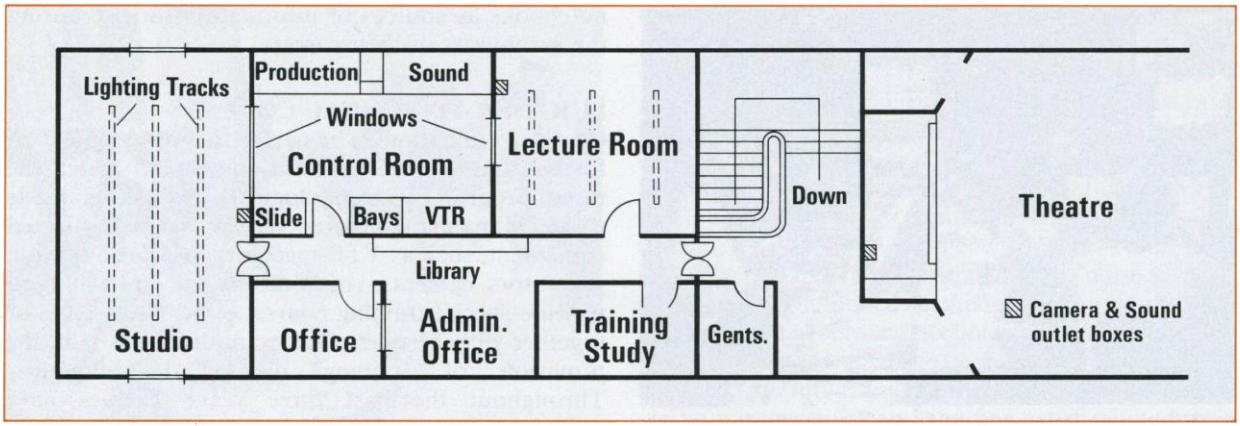


Fig. 1. Layout of the Training Centre at Thames Television.

THAMES TECHNICAL TRAINING SCHEME

This is a one-year course, for the first nine months of which the trainees are directly under the control of the Thames Training Department. The number of students per course varies from six to eighteen according to the projected needs of the Company. The television occupations covered by this training scheme are those of: camera operators, sound operators, film operators and editors, operational and maintenance technicians, and development and installation engineers.

The first two months of the course are devoted to fundamental principles and applications, with lectures on the functions of the Company and the production techniques employed. There are also individual lectures given by members of Thames Television staff who are experts in their field.

The trainees spend the next two months in various sections of the Company other than those in which ultimately they are likely to be employed; and this period is followed by three months of specialist training. The following two months are spent on advanced lectures and demonstrations at the Training Centre and on visits to outside industry. A three-month probationary period, during which on-the-job training is given in their department, completes the year.

FRAMEWORK OF THE SCHEME

The Technical Training Scheme is formed from a series of modules. Each module is divided into about ten topics and each of these is further detailed as to learning objectives. The trainees are given copies of these modules, and so are able to monitor their own progress throughout the course.

The main headings of the modules are:

(*a*) The structure and organisation of television.
(*b*) Engineering technology and principles.
(*c*) The creative aspects of film and television.

Fig. 2. The Thames Training Centre has small closed-circuit cameras. These are in black-and-white but the Studio is now being equipped with a Philips Video 80 3-Tube Colour Camera System with separate remote camera control unit and a vision mixer with special effects including Chromakey. There is remote controlled lighting with a wide variety of lamps and full communications and cueing system. The Students in this sequence of pictures are Trainee Transmitter Engineers from the IBA Harman Training School.

Fig. 3. Technical Trainees on the Studio Training Session are able to practice skills they have learnt on attachment in, for example, the Sound Control room where the Grams operator will be playing in sound effects through the Console which is under the control of the Sound Balancer.

(*d*) The technical process and practices.
(*e*) The creative process and practices.
(*f*) Skills and crafts (including safety aspects).
(*g*) Operational practices—studios.
(*h*) Operational practices—mobile division on location.
(*i*) Operational practices—film (Company division and Kodak Training School).
(*j*) Work performance and practical exercises.
(*k*) Visits and attachments (IBA Transmitter, television equipment manufacturer, film laboratory).

Throughout the course at specific times, assessments and appraisals are made of progress. These are of several kinds including three-hour written examinations, one-hour personal interviews and tests of practical performance.

STUDENT BACKGROUNDS

Most of the students are of the age group to 26 years. About one-third of them hold degrees in engineering, photography or communications; another third have academic qualifications in allied subjects such as technology, music and film. The rest are experienced either in some aspects of television or of a related industry.

All students are provided with literature pertaining to the course and are directed to make use of other published works. Among these, the various volumes of the *IBA Technical Review* are valuable sources of reference. In order to engender an academic approach, students are encouraged to compile notebooks as sources of information for use during the early years of their careers.

FURTHER TECHNICAL COURSES

On this foundation of training, the development of further and shorter technical courses, to match the rapid progress of technological advance, is made easier. Many manufacturers of new and sophisticated equipment, such as VTR machines, telecines, caption generators, cameras, vision mixers, etc, are willing to provide special training courses either themselves or together with Thames. One example of this is in the provision of training in digital techniques. Throughout the past three years Thames have organised a series of digital training courses in conjunction with London Weekend Television. These are arranged within the Television Department of the Ravensbourne College of Art and Design, Bromley, Kent, in co-operation with Bromley Technical College. An article on the services provided by these two Colleges appear elsewhere in this volume.

Thames, in common with other London television companies, has in several ways given practical support to the television Department of the Ravensbourne College of Art and Design. These measures have included donations of surplus equipment, assistance in the installing of a studio complex to broadcasting standards, supply of specialist visiting lecturers and provision of careers opportunities for students. Also, certain outside students who, when about to enter industry, have enquired of Thames, have been directed to the

Fig. 4. The Technical Trainees are given a wide range of practical experience including a television production in one of the main Teddington Studios. Here a small group together with a guitarist are repeating a current production. The Trainees are thus able to compare their performance against a fully professional crew.

Fig. 5. The Training Control Room simulates many aspects of the main Studio Control Rooms with positions for each operational activity. There are full gen-locking facilities and a form of Time-Code which is incorporated into the picture.

College, which has thereby become a source of staff recruitment.

The continued co-operation between Thames, the Colleges and commercial companies, has served also to cement good business relationships with professional organisations including the Royal Television Society (RTS), the British Kinematograph, Sound and Television Society (BKSTS), the Society of Motion Picture and Television Engineers (SMPTE), the European Broadcasting Union (EBU) and other international bodies. Thus the needs of technological change and the development of a new technology emerge as a natural consequence of training and are not seen as merely an unnecessary adjunct to the business operation. This will become more important as we are forced to exploit the full potential of our resources in the ever-increasing competitive world of television that is emerging.

TRAINING OF NON-TECHNICAL STAFF

One area of technical training that can directly relate to exploiting facilities and techniques is in the understanding by production staff of the opportunities and limitations inherent in the television system. To this end we try to embrace a technological background in the training of production staff, especially with regard to directors, designers, researchers, PAs, secretaries and others.

This approach is essentially non-mathematical; and it is concentrated mainly upon demonstrations with operational models and by use of discovery techniques. Thereafter, any production director when, for example, lighting a scene, adjusting the iris of a camera, or editing several generations of recordings, is keenly aware of the potential of video noise towards destroying the intended aesthetic creation. In this way there develops between technicians and production staff, a closer and more sympathetic relationship founded on mutual understanding.

The pure scientist and the fine artist may adopt a stance which can appear to be at opposite ends of natural phenomena and the spectrum of human experience. However, the centre of the stage is occupied by television and it can no longer afford to indulge in any development of this polarisation. The role of education and its institutions plays a vital part in reducing this polarisation and it is becoming essential that industry involves itself with these institutions. Thames, in common with the London Television Companies, has given practical support to

Fig. 6. The far side of the Training Control Room is the Sound Operational Area which has a 10-channel mixer which can be operated as four separate groups. These can be fed to the 4-track Recorder to provide multi-tracking facilities. The Grams and Tape units enable music and sound effects to be incorporated into the programme.

Fig. 7. The recording of programmes is carried out on U-matic Recorders. A portable U-matic and colour camera provide a highly versatile ENG unit for location inserts. The various tapes can then be re-played through this editing complex which provides full remote and pre-roll facilities to either Assemble Edit or Insert Edit with separate sound and visions.

the Television Department of Ravensbourne College of Art and Design in the form of donations of surplus equipment, help in the installation of a broadcasting standard studio complex, the provision of specialist lecturers and also the opportunities for industrial attachment for students.

INFLUENCE ON TRAINING POLICY

Besides providing practical support to the Ravensbourne College, Thames is a member of the Consultative Group which is able to influence the syllabus of training. It is also a member of the governing body which, together with other industries, the local authority and the Department of Education and Science, determines the policy of the College.

At national level, Thames has membership of the Electronics Programme Committee of the Technician Education Council (TEC). This organisation has responsibility for the standards of quality, and the content, of most of the technical courses now available in the UK, including many that are directly pertinent to the television and telecommunications industries. In addition to the close relationships maintained with the professional bodies referred to

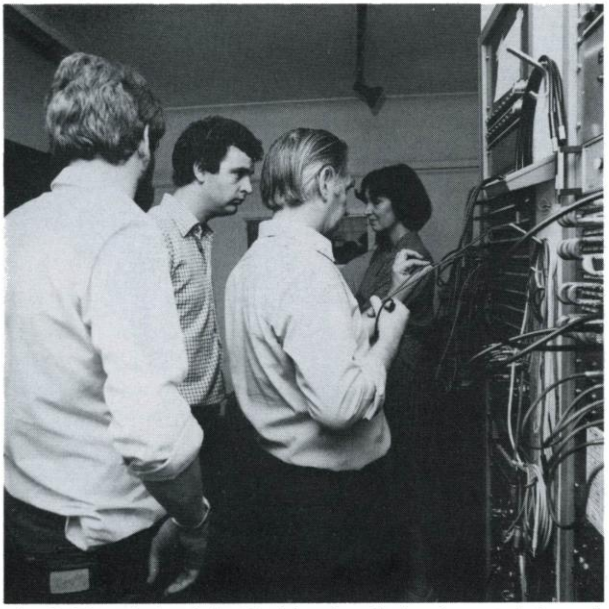


Fig. 8. The whole of the Training installation is routed through these vision and sound Patching Bays which provides a multi purpose use for most of the equipment; Technical Trainees thus get used to exploiting the full resources available to them.

Fig. 9. Among the other courses run in the Training Centre a number are for Production Personnel. Here is a Continuity Course for Production Assistants from a number of Companies within ITV grappling with the problems of continuity in a 'washing line' sequence. The development of the skill of discontinuous recording is made possible by this form of simulated exercise.

above and that with Ravensbourne College there is also liaison between Thames and other companies through the Independent Television Companies Association (ITCA). Thames provides and supports training courses originated by that association. The subjects of these include sound operations, continuity, direction, make-up and other special skills. Also, Thames supports careers seminars for school children, careers advisors and students, with the emphasis on the technical nature of the industry.

PROBLEMS OF TRAINING

One common difficulty in the planning of any satisfactory training operation is that which arises from the differing time-scales which control the education system. These are:

(*a*) Higher education (five to ten years)
(*b*) Specialised training programmes (one to five years each)
(*c*) Training packages (one week to one year).

These can be compared with the time-scales and demands of television production. Hence the integrating of these often conflicting time-scales requires very careful planning of staff complements.

Another problem arises from diversification of duties. Student technicians and engineers need to be introduced to the skills and disciplines of supervision and management. This is because, on becoming Senior Technician, some will occasionally be required to undertake minor managerial and supervisory duties; conversely, those who become Engineering Managers will sometimes still need, besides broad knowledge of system operation, a knowledge of, say, circuitry.

It is more important to look upon this aspect as one of development rather than one of specific training. Few courses have been devised which cover this technical problem adequately and, therefore, many Technical Managers are often criticised for not having the basic skills of Management, especially with regard to inter-personal skills. It is therefore desirable to be conscious of this development at all levels of training and in our Technical Training Scheme we are continually attempting to bring out, for example, elements of leadership and organisation from the trainees.

CONTINUING NEED FOR TRAINING

It is occasionally questioned in some circles as to why we need the sophisticated training that has been outlined. After all, the argument goes, we started Independent Television without such training; people learnt what was needed on their own, and we generally got by with our enthusiasm.

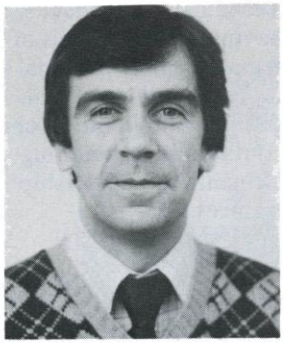
It is easy to become too 'professional' when working in Training and to forget the objective of the training activity. It could be suggested that the results of television training should manifest themselves firstly on the screen and secondly on the balance sheet. It must be seen to improve the programme both as to technical standards and creative impact. With regard to the balance sheet aspect, this should encourage an economical approach to our activities and enable us to become more competitive and effective.

The continuing need for economy, and to remaining keenly competitive, is now seen in the emergence of newly formed Facility and Production Companies. These are able to take immediate advantage of new technology and to operate with a minimum workforce and relatively small capital resources.

The Programme Companies may find themselves under increasing pressures to make the maximum use of their resources, to do this in an economical way and to make it show on the screen. Training has its part to play in achieving all these objectives.

Studio Operations and Maintenance—The National Broadcasting School

by B. Tilcock



BRIAN TILCOCK began his career at the BBC, where he worked in operations and maintenance at Bush House as a sound engineer and later videotape engineer at Television Centre, and at Wood Norton as a lecturer on the technical operators' 'A' course before training radio studio managers and audio assistants at the Langham.

In 1977 he left the BBC to join the British Council as chief engineer with responsibility for radio and TV studios, sound and vision operations, training overseas students and the installation of a broadcast standard three-camera colour TV station. In 1978 he was seconded for six months to Radio Nepal to organise the station's radio operations training and update its installations.

Brian Tilcock is currently the National Broadcasting School's chief engineer.

Synopsis

The National Broadcasting School, an independent organisation supported by the IBA, offers professional training in Radio Production, Journalism, Engineering, Management and Development Support to engineers. Specialist courses geared towards engineering provide a full range of training from the foundation or recruitment level to a more sophisticated level intended for those already employed in the broadcasting industry. Courses providing training in new technology such as digital techniques are also available. There is a great deal of practical involvement at all stages involving the use of the school's extensive studio, editing and outside broadcast facilities.

INTRODUCTION

The National Broadcasting School (NBS) is an independent organisation supported by the IBA which offers professional training in Radio Production, Journalism, Engineering, Management and Development Support Communication.

The courses which are specifically geared towards engineering consist of a foundation or recruitment course, intended for trainee radio engineers, followed by a series of more specialised one or two week courses designed for engineering staff already in the industry or on-station.

At this point it is important to expand on the term engineer. On some stations this may mean a maintenance engineer with responsibility for keeping the station on-air and the equipment and installation up to Code of Practice. It could also mean an operational engineer or technical operator with responsibilities such as operating the equipment, handling Outside Broadcasts, controlling the station's output or recording, editing and transferring to cartridge programme material, in addition to some first line maintenance.

It is more probable, however, especially at smaller stations, that it will be a combination of the two, the operational, and the maintenance engineer. This leads to a dichotomy in the training programme and the need for separate operational and maintenance training.

Fig. 1. The National Broadcasting School is fortunate enough to be housed in a Jacobean building listed grade 2. In its time it has been used for film production, housed a sporting club and been used as a warehouse. The interior has now been completely redesigned to meet the School's requirements.

THE SCHOOL'S FACILITIES

The philosophy adopted in setting up the School has been that, in order to train people in the art and skills of running a radio station, the School must have similar facilities. Hence the NBS has been built on the lines of a broadcast-capable radio complex with self-operated studios, a master control room, a newsroom, an engineering workshop, a drama/music studio with studio and cubicle areas having 16-track capability, plus a number of lecture rooms with other training areas.

The engineering workshop is equipped both as a training area and with the facilities needed to keep the station running. To this end it has a range of test equipment which a trainee is likely to encounter on station.

In the final weeks of the foundation course, trainees take part in the daily maintenance occurring at the School, and so gain first-hand knowledge of working in a maintenance team supervised by a senior engineer. They are also on standby call during the Radio Production exercises to solve any operational or maintenance problems under supervision.

The School has dismountable equipment suitable for OB training and permanent lines to the British Telecom Tower. A programme ring main extends around the whole building in order that the various studio outputs may be monitored. Numerous editing booths (Fig. 2) and transfer suites are also available for disk-to-tape, tape-to-tape, tape-to-cartridge or tape-to-cassette transfer.

A number of portable machines, both Uher and Marantz, are available for student use and various types of microphones are kept so that different techniques may be tried out.

A range of audio-visual aids are used for teaching,

Fig. 2. One of the School's eight tape editing channels being used in a tape editing exercise.

including overhead projectors and white boards, flip charts and slide projectors, plus 16mm film and small format VTR (Philips VCR and VHS).

Much of the information given to students is in the form of handout material which is stored on magnetic disk for retrieval on a word processor. This system enables immediate updating of the material by revising the disk before printing. The word processor has a high speed printer which enables handout material to be produced rapidly.

FOUNDATION COURSE

To ensure versatility of skills for a person completing the course and going on to join a radio station's engineering team, the NBS aims to train the student in both basic operations and maintenance in order that someone joining the industry does not specialise prematurely.

Hence the course is divided into three modules, each of four weeks duration.

Module One

This consists of basic electronic fundamentals, the entry requirements being 'O' level passes in English and Physics and at least further study in these subject to 'A' level standard or an equivalent. Relevant work experience also counts towards the entry requirements, and the case of each student applying is considered on its merit.

The content of this module is intended to equip the student with the vocabulary and electronic theory necessary to make good use of the hands-on learning experience contained in Modules Two and Three. The concept of magnetic recording is also introduced here and linked with practical experience of mono tape machine line-up and use of simple AC test gear. Alternatively a qualification in electronics such as City and Guilds Telecommunications, OND or HND would constitute an exemption from this module. The theoretical content of Module One is available as a correspondence course.

Module Two

This can be taken directly after satisfactory completion of Module One or, alternatively, after a break of two to three months, during which time the student would return to duties on station to gain more 'on the job' experience. Module Two is practically based and is intended to give grounding in technical operations with emphasis on putting the student in the 'on-air' situations encountered in control room working and studios. This is achieved by the use of structured programme exercises ranging from simple one or two source or microphone balances to full sports or newsreel style programmes. Outside Broadcasts are also catered for, the complexity depending on the source material available. They range from sports recording through music concerts to coverage from theatres or halls.

Principles and practice of stereo recordings, music, drama and talks recordings, commercial production and simple multi-track operations are also included

Fig. 3. Students using Studio 6 for a drama recording session.

Fig. 4. An Engineering student familiarising himself with one of the four self-operated studios.

Fig. 5. Students carrying out a measurements practical in the Engineering Workshop.

(Fig. 3). To complement and reinforce the practical sessions, a series of lecture demonstrations are given in such subjects as the broadcasting chain, programme levels, the PPM and VU, types of microphone, loudspeaker construction, tape editing, speech and music, portable tape machine line-up and cartridge and cassette usage. Visiting lecturers are brought in to cover some of these subjects.

Students are also encouraged to produce a feature of 10 to 15 minutes duration (Fig. 4) for use in a two or three-day network exercise during which they are given the task of running the school radio station. This is intended to give first-hand experience of the problems which they will certainly encounter when working on station. At the end of each day's schedule a debriefing session is held to check out the programme log, analyse operational errors and to establish where and why individual problems have occurred.

The network exercise is generally held as the culmination of the month's work before the operational tests, and is found to be enjoyable and of much value to the students.

Module Three

Again, this can follow either immediately on successful completion of Module Two, or, after an interval of a few months. This allows a Chief Engineer to structure periods of on-station training for trainees. In this case an extended period of operational training would be suitable and the school is only too pleased to advise Chief Engineers, or their training deputies, as to what form of on-station experience would most benefit their trainees. Module Three is heavily orientated towards maintenance and starts with a more comprehensive look at the test gear required to carry out accurate measurements (Fig. 5), the recording of results, and hence the need for detailed maintenance logs.

This is combined with a series of practical sessions where most of the test equipment commonly found in ILR stations is used to measure the parameters of various items of equipment found in the broadcasting chain.

At this stage in the course the IBA's Quality Control section is invited to talk in simple terms about the Code of Practice and the associated tests that are carried out both for a new station and the yearly check of a station already on-air.

This period also includes formal lectures about audio circuit techniques, transistor and valve amplifiers, operational amplifiers, servo systems and stereo line-up. The principles of digital electronics are covered from basic gates to simple microprocessor applications and application to audio engineering such as the Compact Disc.

During the final week of the course, students undertake a project which presents a maintenance problem, this has to be solved by finding the relevant information from manufacturers' manuals and then working logically on information given by the manuals and by the lecturing staff. It is designed to test the logical thought processes necessary for speedy fault finding and to indicate to the student where information can be found and how it should be used. Over this period of time their performance is being observed quite carefully whilst carrying out these tasks and an appropriate assessment made.

ASSESSMENT AND QUALIFICATION

Continuous assessment is used with weekly tests involving multi-choice questions to check the student's understanding and retention of the lecture and demonstration material. Operational tests are used to assess the student's performance in topics such as tape editing, mono tape machine line-up, timing and logging, amplifier testing and disc cueing. These tests are carried out in conjunction with a weekly tutorial, which provides students with instant feedback, showing how well or how poorly they are progressing. This is a much fairer system than a final test, for, if a student fails at the end of a course there is little he or she can do to make amends. However, with a continuous assessment system, the student knows

from the beginning how he or she is performing and also what are the pass criteria.

Successful trainees who have taken the full course, be it for three months continuously or by separate periods spaced over a year, receive the NBS Engineering Proficiency Certificate which is based on the results of continual assessment at the School. If The student undertakes the period of on-station training the certificate may be validated by the Chief Engineer of that station after three months satisfactory work.

TRAINING TECHNIQUES

The purpose of an effective training course is to achieve one or more of the following objectives:

(*a*) To provide new information—students end up knowing more.

(*b*) To improve and develop new skills—students can apply their acquired skills effectively.

(*c*) To change attitudes—students are motivated to apply the new knowledge.

In just the same way each lesson, lecture or practical session should have its own set of objectives and it is the purpose of testing to check whether these objectives have been achieved.

As a basis for assessment and an aid to validation, objectives have been considered as falling into three categories, each related to the type of learning involved. These can be summarised as practical skills, attitude changes and intellectual skills. Intellectual skills are further sub-divided to give a gradation from shallow to deep thinking.

In training terms, an objective is a statement of intent and describes some proposed change in a learner. Anyone reading a list of objectives should be able to decide how it is intended that the behaviour or performance of a student be changed by the particular learning process specified.

All modules for courses organised by the NBS are outlined by a statement of objectives expressed in behavioural terms.

TRAINING TARGETS

Lists prepared under the three headings shown in Fig. 6 serve as valuable aids during the preparatory stage of any training course. The NBS have compiled such lists with the help of the Managing Directors and Chief Engineers of the Independent Local Radio Companies. The headings used are:-

Must know This covers the information which is the essential core of any activity.

Should know Embraces valuable material which should be covered if time permits.

Could know Covers the interesting 'frills or fringes'.

COURSE EVALUATION

Course evaluation is necessary at the NBS in order to ensure:

(i) That the course content or programme is validated i.e., by checking that the training achieves its objectives effectively.

(ii) That the trainee has reached a particular standard of performance having attended the course.

(iii) That in selecting applicants the candidates are equipped to attend a course and benefit from it.

(iv) That feedback indicates the effectiveness of the course and the training techniques employed.

The attractiveness of a course will in the longer term depend on its reputation which will, in turn, depend on the opinions of those who have attended it in the past. By and large, if the content is of value to the students in their work or operational tasks, then the course will be well received.

As trainers of broadcasting staff we are concerned with assessing objectively the acquisition of skills and knowledge of systems. To this end both operational and multi-choice answer tests are used to assess the trainee's performance.

We are also concerned with how the course has been received and how, in the trainee's opinion, it could be improved. This is usually carried out by the use of a questionnaire, or form which is supplemented at NBS by an end of course interview which pursues distinct areas of enquiry.

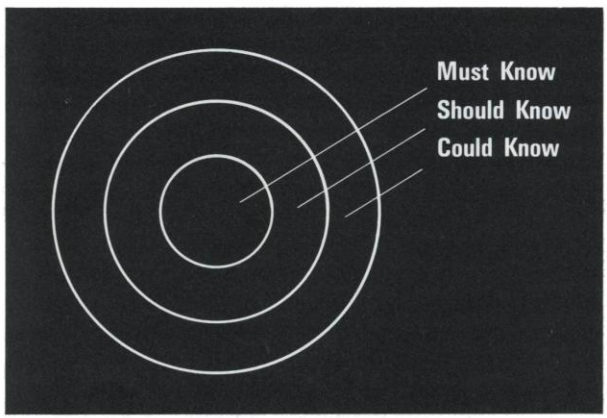


Fig. 6. Training targets. These can be defined as a central core which the student must know surrounded by valuable material he should know and an outer periphery of material of interest which he could usefully know.

SPECIALIST ENGINEERING COURSES

In addition to the foundation course, the school runs courses for engineers already engaged in broadcasting, with a view to updating their knowledge and introducing them to new techniques. These following courses are run as and when the demand occurs.

Sound Refresher Course

This is a one-week course intended to update station staff as to recent developments in equipment and techniques used in radio. It covers subjects such as digital recording, new microphones and loudspeakers, limiters and compressors, noise reduction and companding. A day is spent on multi-track recording techniques involving a track-by-track recording session and then a subsequent mixdown. Some evening work is also involved.

Digital Techniques Course

Intended as a general introduction to current practice in the applications of logic circuits, all examples are taken from modern practice and the course is self-paced. Engineers completing the course will have acquired the ability to use published information when fault-finding on specific devices or equipment.

Multi-Track Recording Course

An intensive course of one week's duration, this caters for a maximum of twelve people. Students are given a great deal of 'hands on' experience. An introduction to the techniques and disciplines of programme production is given using multi-track equipment. Music, drama recording and production is involved. Applicants should be able to demonstrate a working knowledge of mixing desks, microphones and recording equipment, and are expected to work in the evenings.

Technical Operations Course

Aimed at providing a professional level of competence in the handling and operation of the equipment usually found on ILR stations, the course lasts one week and is suitable for non-technical broadcasters and newly recruited engineers to the industry. Topics covered are operational line-up, programme fault identification, programme levels, the use of desks and mixers and newsroom operations. Some time is spent in giving 'hands on' experience of microphone placement and balance for talks and simple music balances in stereo. Speech and music editing are covered and students have a chance to practice and combine these newly acquired skills during evening rehearsals and recording sessions.

Radio Outside Broadcast Course

Designed as an introduction to the problems of carrying out such work and run as an intensive one-week course, this covers such subjects as mobile equipment, site surveys, rigging on site, lines, radio links and communications. Practical experience is offered of one or other type of OB such as a church service, brass band concert, sports fixture or rock concert, depending on availability at the time and may be covered using demountable equipment or an OB vehicle. A great deal of evening work is involved.

All of these courses are intended to improve the technical quality and standard of operations in Independent Local Radio. They also aim to provide more insight and job satisfaction to those people employed and at the same time generate new ideas. The overall objective is to achieve in practice the concept expressed in the National Broadcasting School motto: 'Excellence in Broadcasting'.

ALAN RITCHEY
B.Sc., C.Eng., MIEE,
Head of School of Electronic Engineering at Newcastle Polytechnic as well as Course Leader for the Polytechnic Diploma in Broadcast Engineering, has taught at Newcastle for about 20 years, previously having worked for GEC Telecommunications. Additionally he had some undergraduate training experience with the BBC in the mid-1950s. His main professional interest outside teaching is the application of microelectronics to the automobile industry. As a Consultant to a local firm this has involved work for British Leyland, Vauxhall and Perkins Diesel.

Newcastle upon Tyne Polytechnic Diploma in Broadcast Engineering

by A. Ritchey

Synopsis
The Polytechnic of Newcastle upon Tyne has a large School of Electronic Engineering within the Engineering Faculty. A 27-week course is provided by the School, with assistance from the School of Physics, tailored to the needs of the IBA's engineering training scheme. Covering general theory and principles of electronic engineering by means of a syllabus devised jointly by the IBA's Technical Training Group and Station Operations and Maintenance Department, this course complements the specialist training in broadcast engineering given at the IBA's own Harman Engineering Training College, and is an integral part of the training given to trainee broadcast engineers.

INTRODUCTION

Newcastle upon Tyne Polytechnic is one of the larger Polytechnics with almost 7,000 full-time students. The actual student population at any one time can be much larger than this as the related courses are a mixture of full-time, thin sandwich (in which the students attend for 24 weeks in any year) and also part-time, both day and evening. Due to the mix of courses referred to, the Polytechnic is open to students for teaching *and* support facilities for twelve hours a day.

The Polytechnic is housed on two modern sites; the main one being an educational precinct within walking distance of the city centre. This is especially important in relation to the Metro transport system, an underground railway within the city giving a high frequency, high speed integrated system along both banks of the River Tyne thus allowing students to choose from a much wider range of living accommodation than would otherwise be possible. In particular, the coastal towns such as Tynemouth and Whitley Bay, with their surplus of accommodation in the winter months, are within easy reach. These factors were of some importance in the forming of the decision by the IBA to bring the Polytechnic Diploma Course to Newcastle.

The course is centred within the School of Electronic Engineering which is part of the Faculty of Engineering. The latter is one of eight Faculties in the Polytechnic and in total there are 34 schools within these Faculties. The School of Electronic Engineering comprises 24 academic and 12 technician staff covering the specialist subjects of Communications, Computer Technology and Microprocessor Applications, Control and Instrumentation Systems,

Fig. 1. The School of Electronic Engineering is housed in modern buildings at the Polytechnic of Newcastle upon Tyne.

Digital Systems and Electronic Circuits; the School of Physics within the Engineering Faculty provides the necessary specialism in Acoustics and Optics for the Course in Broadcast Engineering.

The School of Electronic Engineering has a very active research and consultancy programme which is aimed at providing a body of staff who are not isolated from the attitudes and problems of industry. At present the School has research and consultancy contracts to the value of more than £200,000 in Communications, Computer Technology and Software and Microprocessor Applications.

The Communications work is centred around Satellite Broadcasting with the development of a tracking receiving system to complement the fixed aerial system. The work also includes the associated low-noise receiver design. The facilities provided by the IBA, for seconding a member of the Polytechnic staff to work in the Crawley Court Research Laboratories for three months, are greatly appreciated. Computer work is done in co-operation with the firm of N.E.I. Parsons; one part relates to shop floor data management systems; the other relates to energy management within the production areas. The main microprocessor work is also of two parts; the one in association with Courtaulds involves automation in the knitting and sewing industries while the other relates to automated measurements on semiconductor materials as required by device manufacturers.

In addition, the School has at any time at least one member of staff seconded to the Microprocessor Applications Research Institute (MARI) which is a collaborative venture involving the School of Electronic Engineering at the Polytechnic, the Department of Computer Science at Newcastle University and the software firm Computer Analysts and Programmers Ltd. (CAP). MARI provides a consultancy design service for the industrial applications of computers and microprocessors, initially for local needs but increasingly for national needs. This service was set up in 1978 and is already expanding its premises on a site situated between the Polytechnic and the University.

CONCEPTUAL PROPOSALS FOR THE DIPLOMA COURSE

The outline proposals for the Course were originated by the Independent Broadcasting Authority, having been developed by staff of the Station Operations and Maintenance Department and the Harman Engineering Training College. Several Polytechnics were visited in a selection process; and, as a result, Newcastle Polytechnic was invited to join with the IBA in developing and operating the course. The object from the outset was that the course should merit some form of national recognition. At the time of the early planning the Technician Education Council Higher Diploma Courses were beginning to be offered in a wide range of disciplines. After discussion which also involved representation from the Department of Education and Science, the view was taken that the proposed course was much beyond the standard of a Higher Diploma and that some other form of national recognition was required. This has proved extremely difficult to provide mainly because of the unique nature of the course. However, the problem is still under active consideration. Meanwhile, the course runs as a Polytechnic Diploma Course with external moderation of the examinations.

The subject boundaries were originally defined by the IBA. The necessary syllabus content was then produced by a working committee with representation from the two IBA departments previously mentioned and also from the Polytechnic. There are six of these subjects in the Polytechnic part of the course:

(i) Basic Circuit Theory
(ii) Signal Theory
(iii) Electronic Devices and Circuits
(iv) Digital Circuits and Systems
(v) Principles of Sound and Television Broadcasting
(vi) Propagation and Coverage.

These are taught during 25 weeks which period includes an introductory week and final examinations

at the end of course. The Christmas vacation occupies two weeks. This course at the Polytechnic provides a broad educational experience for students to develop a knowledge of the operating principles and component parts of modern broadcast engineering systems. In so doing, it develops the analytical and deductive skills necessary for meeting the challenge of maintaining equipment which embraces a wide range of new technologies. Further objectives are: to render the engineers more self reliant in coping with the problems presented by the new equipment, and to include in the Polytechnic part of the course a suitable introduction to the more specialised work on transmitting equipment contained in the final phase of the training at the Harman Engineering Training College.

This final phase is of 28 weeks instruction in the following subjects:

(*a*) Principles of Television Broadcasting
(*b*) Programme Input Equipment
(*c*) Video Measurements
(*d*) Transmitters
(*e*) Aerials and Feeder Systems
(*f*) Telemetry and Remote Control
(*g*) Electricity Supplies.

COURSE OPERATION

Prospective students are interviewed at Transmitter Stations during the period January to April and the successful applicants start at the Harman Engineering Training College in late June. The format for the overall scheme is given below:

Induction Course, Harman Engineering Training College	9 Weeks
Station Training	3 Weeks
Polytechnic Course, Newcastle upon Tyne	27 Weeks
Station Training	5 Weeks
Transmission Technology, Harman Engineering Training College	28 Weeks
Station Training	7 Weeks.

The Induction Course includes one week at Thames Television Studios.

The entry qualifications normally required are:

(i) Higher National Certificate in Electrical and Electronic Engineering
(ii) Higher National Diploma in Electrical and Electronic Engineering
(iii) City and Guilds Full Technological Certificate in Telecommunications.

In the future these will be replaced by the equivalent Technician Education Council (TEC) qualifications.

About 75% of the intake have the above qualifications, the remainder being a mixture of graduates and holders of specialist qualifications such as marine electronic engineers and radio and television engineers. The successful entrants are selected from several hundred applicants. Students from other organisations could be accommodated on the course but this would require a reduction in the number of IBA students because the total annual intake is limited to 24 students.

At the Polytechnic the students have $26\frac{1}{2}$ hours of lecture, laboratory and tutorial work in any one week. This is spread over four days to allow a long break every second weekend for their return home should they so desire. The lecture work and seminar work are of hourly periods and the laboratory periods are each of $3\frac{1}{2}$ hours duration.

At approximately monthly intervals throughout the course the students are assessed. The final decision as to whether a student has passed a subject is made on a weighted total, on a 1 : 2 : 2 from the continuous assessments, the laboratory work and the final examination.

The teaching programme includes both traditional and modern technologies. For example, in the subject of line communications, the experimental work starts with a simulated line which is a quarter wavelength long at a few kilohertz; the students then move on to slotted line equipment and finally to microwave test benches. At all times there is an integrated approach to the teaching. This is equally well illustrated in the teaching of the microprocessor and computer programming aspects of the course. The microprocessor teaching concentrates initially on system architecture; and as a result is at the machine code level of programming whereas in computer programming the emphasis is on a structured approach to the subject. The two are brought together by the assembly language teaching in the following way:

The School of Electronic Engineering has three laboratories devoted to microprocessor teaching and an additional Computer Technology laboratory equipped with six identical 6800 development systems each with a visual display unit and a powerful monitor providing all the necessary facilities for program development. These include examination and modification of all internal registers and memory

Fig. 2. Previously prepared programs can be stored on cassette and reloaded later as on this example of a microprocessor development system.

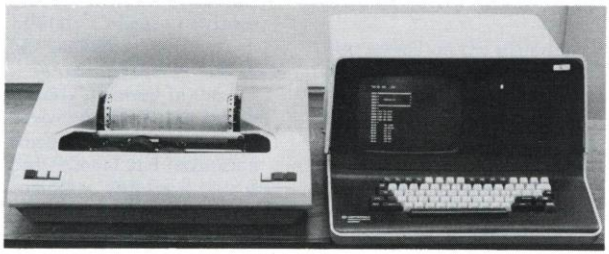


Fig. 3. Here a more advanced development system is shown with a printer for producing hard copy.

locations, trace features, program disassembly and a line-by-line assembler. The students work in pairs with this equipment but have individual access to it at lunchtimes and during the early morning or late afternoon periods. One of the other laboratories, although primarily for 8080/Z80 systems, provides further facilities for the 6800 work. Both laboratories provide interfacing boxes which facilitate the transfer of data in and out of the microprocessor system. Two examples of typical development systems are illustrated below (Figs. 2 and 3).

The computer programming is conducted entirely by use of Polytechnic Computing facilities, and with emphasis on line usage, and consequently each student has access to a terminal, as shown (Fig. 4).

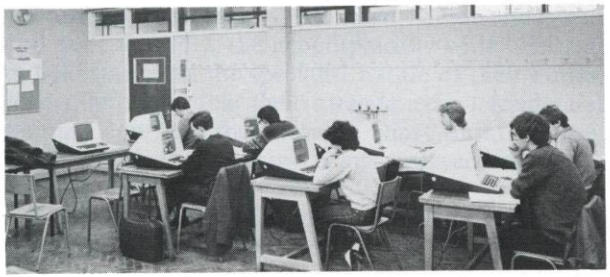


Fig. 4. The Polytechnic Computing Facilities provide each student with access to a terminal.

The Polytechnic has a Data Dynamics Nova Computer mainly providing facilities using BASIC as the high-level language. It has also two Harris Computers, a 125 and an 800 which provide a range of languages including BASIC, FORTRAN and PASCAL. The Polytechnic is also a terminal of the IBM 370/168 Computer at Newcastle University.

The Broadcasting Engineering students use the Harris 800 with BASIC as the operating language. They also use the file editing system which enables continuation of the work after a break period. Casual terminals are available so that the students can continue their work outside normal lecturing hours.

The Harris 800 system has a 6800 assembler and simulator for bridging the gap between the two parts of the syllabus previously described. The assembler allows the students to generate an assembly language file with the usual conventions with regard to labels and comments. They can also again use the file editing facilities, wherein the high-level languages serve to simplify the work of program development. Having assembled the program the students can then run it on a simulator which to all intents and purposes makes the computer terminal look like one of the development systems previously used in the microprocessor laboratories.

Typical results for a very elementary time delay program are shown below (Fig. 5).

FUTURE DEVELOPMENTS

The IBA and Polytechnic staffs are continually assessing the Diploma course and its development. When the course was originally conceived the maintenance engineers were not expected to write or modify computer programs but only to understand them. Now that the writing of programs is included, in future there will be an increasing emphasis on software.

As the number of prospective entrants with Technician Education Council qualifications

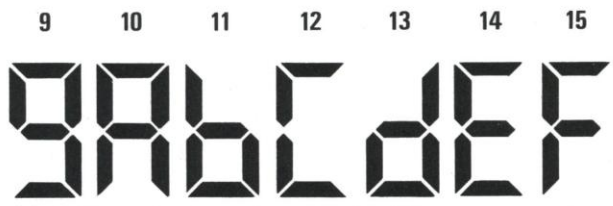


Fig. 5. The results for an elementary time delay program are shown on a VDU.

increases, a wider spread in entry qualifications must be accommodated. Finally, there remains the external validation of the course and, by implication, of the teaching at the Harman Engineering Training College. In the post Finniston period we are probably moving into the area of technician engineering degrees which may well turn out to be the direction in which the course develops.

IBA Residential and Remote Training Schemes

by A. W. Reading

ARTHUR READING, OBE, MC, TD, C.Eng., FIEE, FIMech.E, FBIM, joined the Independent Broadcasting Authority in March 1977 as Head of Technical Training after a military career in REME. Educated at Timaru High School, New Zealand, and Acton Technical College he later served a student apprenticeship with the Lancashire Dynamo and Crypto Ltd and subsequently graduated from the Royal Military College of Science, Shrivenham.

In recent years he has been directly involved in the development of training and engineering enhancement of professional and technician engineers, and for a time was the Director/Commandant of the REME School of Electrical and Mechanical Engineering, Arborfield. He also served on the planning committee that set up the Singapore Government Engineering Training Board and planned the expansion of the Singapore Polytechnic.

An active member of several professional engineering and management institutions he currently serves on various boards and committees.

Synopsis

The rapid advance of electronic technology, with its ever increasing production of new systems, poses special problems in the training of broadcast engineering staff, many of whose duties change in accordance with those advances. This chapter describes the main methods of training applied by the IBA; and, in particular, a 'remote learning' scheme by which individual members of staff are encouraged to study, at will, and at their own individual speeds of learning. Within the IBA, this novel scheme besides proving efficient and economical, has been favourably received by field staff and by Headquarters engineering staff.

INTRODUCTION

In any broadcasting organisation the training of engineering personnel poses two main problems. Firstly, the continuous and rapid advance of electronic technology demands that training programmes be constantly reviewed, augmented and updated; secondly, the geographically wide dispersal of field staff, and the specialist nature of their duties, render impracticable their attendance on residential training courses other than of short duration, any longer residential courses being reserved for newly enrolled personnel.

In the early days of Independent Television, the less sophisticated equipment then used rendered more simple the training requirements, and use was made of short-term training courses provided by certain colleges and by equipment manufacturers. The curricula included items such as the principles of early electronic devices, combinational and sequential logic and Boolean Algebra. By the mid-1960s, new techniques and equipments were being introduced in rapidly increasing quantities; and the IBA foresaw the need of providing in-house training. Accordingly, this was established, first in London, and later also at Stockland Hill, and these arrangements sufficed for several years. Need of still further training facilities then became apparent; and so, the Harman Engineering Training College (HETC), at Seaton, Devon, was opened in September 1976.

Initially, HETC provided short training courses chiefly for IBA transmitter maintenance staff; but its

functions have since expanded to include certain longer training courses for new entrants. In addition to these courses, some specialist training courses are used for small numbers of staff at Leeds Polytechnic.

The early digital courses at HETC needed to include the fundamentals of digital electronic engineering because the computer industry had been developing for many years prior to the introduction of its technology into broadcasting. Nowadays, new forms of computer technology, and especially of systems such as those of intelligent communication and executive control, are becoming commonplace; and, unfortunately, in certain industries which have hitherto been highly labour intensive, these modern developments are sometimes fiercely resented. However, within the broadcasting industry, which is not especially labour intensive, engineers tend to regard each new development as an exciting and invigorating challenge, an elevated arena from which many of them are able to foresee and possibly to contribute towards the shape of things yet to come. It is with a view to encouraging and stimulating such keen interest that the IBA training programmes are designed.

CURRENT TRAINING REQUIREMENTS

Current requirements of training in digital electronics for broadcasting can be divided between: Software, Hardware, and Maintenance and Diagnostics.

Software

The terminology and techniques used in the production of software for microprocessor and computer systems are introduced at an early stage of the training programme. This is necessary because, although few broadcast engineers are likely to become computer programmers, they require adequate training to understand, and to maintain, equipments embracing the new technology. Hence, machine code and assembly code programming are items for early consideration.

During 1981, training on a microprocessor system with a VDU and high-level language (BASIC) capability was introduced, to cover microprocessor disk systems, VDU and GP/B interfacing. Training plans for 1981–82 include programming in other high-level languages such as PLM. This becomes necessary for understanding of the IBA Regional Operations Centre computer, Argus; and, initially, the training will be provided by the manufacturers of that equipment, Ferranti.

Hardware

This aspect presents fewer problems, because field engineers of the IBA are experienced in working with highly complex electronic equipments. Since 1978, further short courses on digital and microprocessor equipment, notably at HETC and at Leeds Polytechnic, have embraced new concepts such as peripheral devices, bus structures, specific microprocessors and supporting integrated circuits.

Maintenance and Diagnostics

Maintenance of processor systems, and fault locating within these, can each be divided into Software and Hardware techniques, and much additional training now needs to be provided here.

Introduction to the new test and measurement instrumentation applicable to microprocessor systems, and to the associated documentation is essential. These will be important subjects in future residential training courses; and a new training package for 'remote learning' has now been introduced.

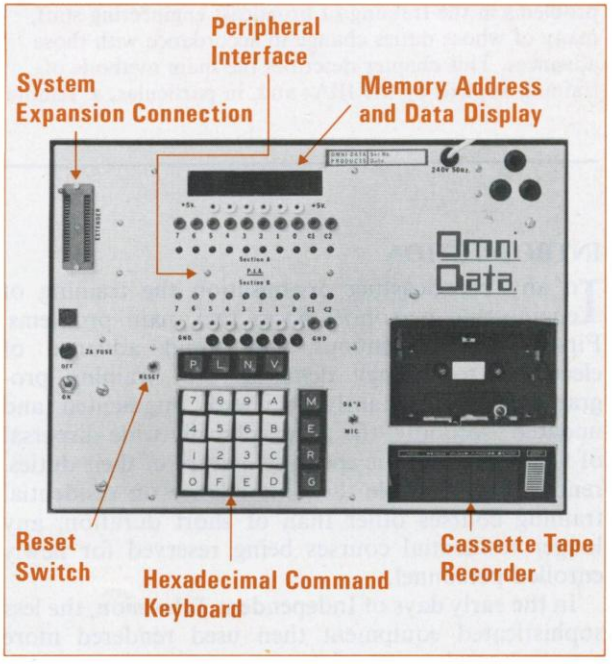


Fig. 1. A view of the Motorola 6800 based microprocessor training kit designed at Harman Engineering Training College.

IBA INTEGRATED REMOTE LEARNING SCHEME

Although the short residential courses, especially those at HETC and at Leeds Polytechnic, have helped IBA staff towards a broad understanding of microprocessors, more extensive involvement with these techniques was found necessary; and, in 1978, a working party investigated how best to meet this requirement. Thus, in early 1979, the decision was taken to purchase a number of portable microprocessor development systems, and to distribute these individually, on loan, among members of field staff and to Headquarters and operational engineering staff. This novel method of staff training is known as the IBA Integrated Remote Learning Scheme. Each provision is of a training package, comprising microprocessor training kit, documented lessons, manufacturer's documentation, and worked exercises together with model answers. The whole is easily portable and is contained in a neat carrying case.

The cost of this scheme is more than fully compensated by the resultant savings of travelling costs, of temporary replacement staff and of subsistence charges. Also, by omitting direct supervision, the scheme encourages conscientious effort and exploration; the qualities which are essential in all engineers concerned with diagnostics. A further advantage is that students can work at their own individual speeds rather than at any group tutorial rate. Student response confirms that, whereas at first certain members of staff showed reluctance towards accepting the scheme, it is now widely welcomed.

During the early development of course lessons for this scheme, many people contributed by working on specimen exercises designed to ensure clarity throughout the text. The levels of their prior knowledge varied widely; and their findings greatly assisted the work of document revision. Also HETC affords 'phone-in' facilities for the solving of problems; and the feedback from these services has further assisted towards revision of text, as well as in the designing of new training packages.

The First Remote Training Package

Training Kit D2—(available 1979)

The Motorola 6800 microprocessor system was chosen for this package chiefly because it was

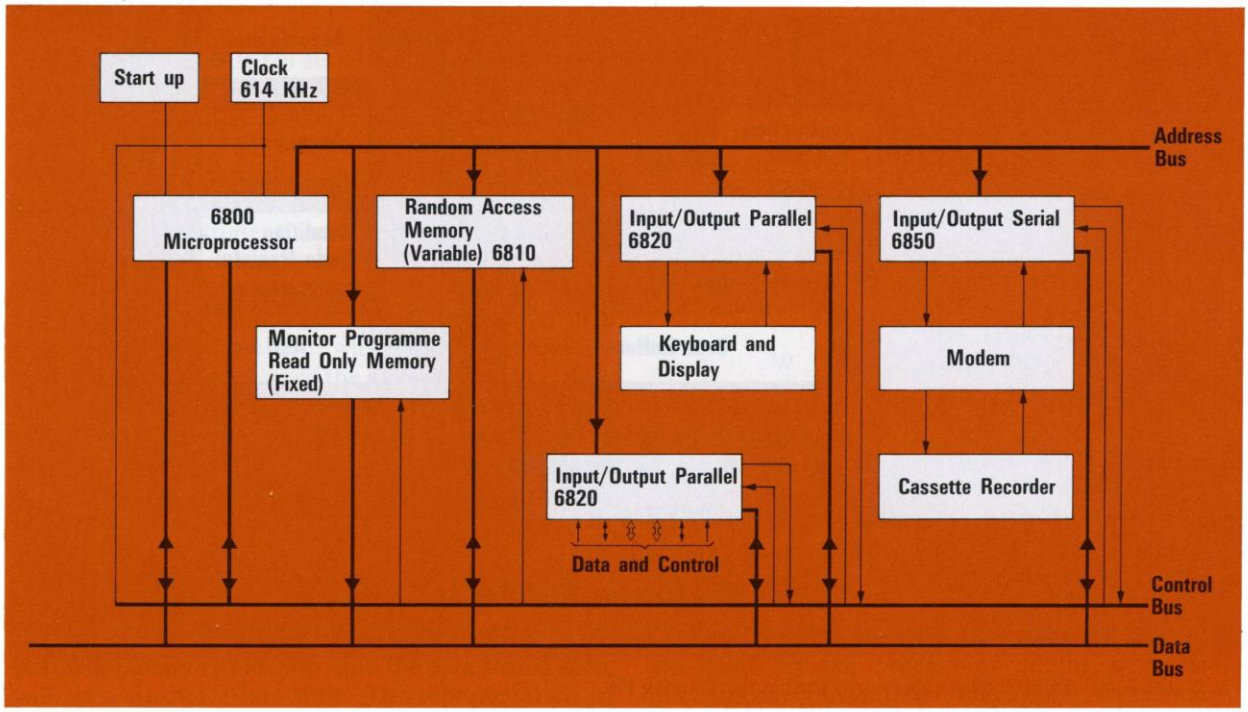


Fig. 2. The training kit is a self-contained computer with built-in cassette data storage. Parallel and serial data inputs and output ports are also available.

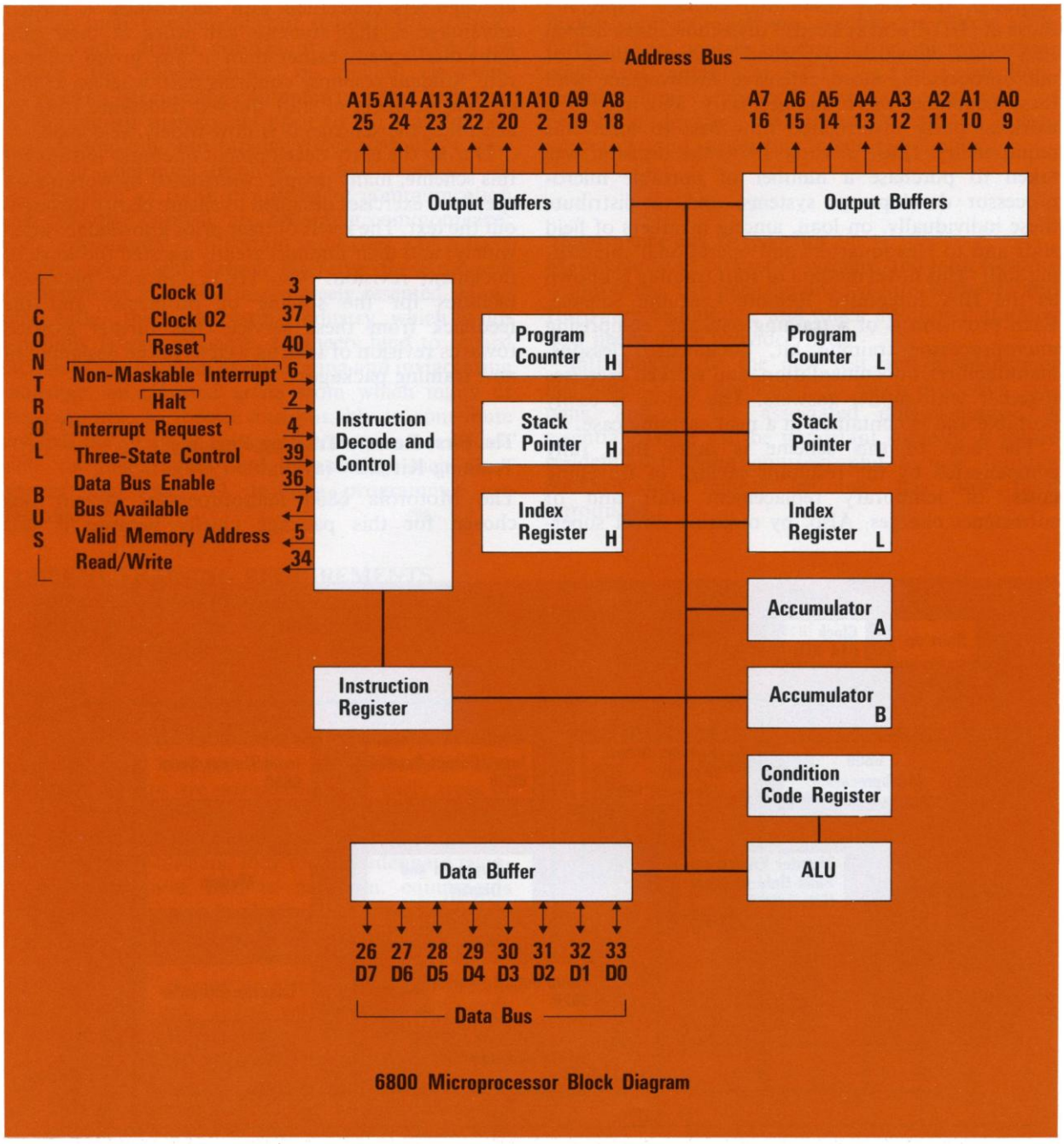


Fig. 3. The Motorola 6800 microprocessor is used in the Training kit.

available in kit form and included a suitable monitor programme. IBA modifications included the addition of a socketed peripheral interface adaptor with buffered LED read-out, a cassette recorder and a system expansion connector. Figure 1 shows a plan view of the package. The first lesson indicates the method of operating the package and contains block schematic diagrams of the system and of the microprocessor, as here shown in Figs. 2 and 3.

The microprocessor system

The 6800 microprocessor is used in conjunction with other devices such as read-only and random access memory, input/output devices and a system clock each in a separate training package. The microprocessor communicates with the memory and input/output devices (peripheral interfaces) via three highways or bus structures. These are: the Address Bus, the Data Bus and the Control Bus. The Address Bus communicates with the specific memory locations, and the bi-directional Data Bus conveys the data to and from these memories.

Because the microprocessor is required to transmit and receive information to and from the outside world, the training kit has two parallel peripheral interfaces. The associated peripheral unit could be any external device such as a keyboard, VDU or telemetry system. Also, a serial peripheral interface is provided to permit transmission of serial data. Within the training kit it is connected to a frequency-shift keyed modem. The frequency modulated audio carrier can be recorded on the cassette tape, thereby enabling storage and recovery of programs prepared by the student and contained in the volatile memories of the microprocessor.

Early lessons are designed to ensure clear understanding of numerical systems expressed in a base other than those with which IBA engineers are likely to be familiar. Use of the hexadecimal notation, and its application to computer programming are suitably explained, as are negative numbers and forward and reverse branching within computer software. Here follow two extracts from a typical lesson on the subject.

Typical lesson—Example 1

THE HEXADECIMAL NUMBERING SYSTEM

A 16-bit binary number is used for addressing a particular memory location; and the data stored there will be a further 8-bits wide. The representation of these in binary form would typically appear:
0000, 0001, 1010, 1011, 1111, 1001.

To the human mind, this is difficult to comprehend; and mistakes in its interpretation are easily made. Many shorthand notations have been used in efforts to overcome this problem; but, in the microprocessor field, the hexadecimal notation is the one most commonly used. This is an alphanumeric system in which the numerals from 0 to 9 (inclusive) are represented by the conventional symbols (0–9) and those from 10–15 (inclusive) are represented by the first six letters of the alphabet (A–F). See Table 1.

TABLE 1: DECIMAL/HEXADECIMAL NOTATION

Decimal	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Hexadecimal	0	1	2	3	4	5	6	7	8	9	A	b	C	d	E	F

[The lower case for b and d above is due to the limitations of the seven segment displays, where otherwise a 'B' would be identical to an '8'.]

From the foregoing it can be seen that the previously quoted binary number can be represented in hexadecimal notation as follows:

0 1 A b F 9

Digital values may readily be indicated on a modern seven-segment display. Four binary bits, representing any decimal number up to 15, would require two seven-segment displays and two decoders if the display were to be in decimal. However, the seven-segment display can indicate many letters of the alphabet; but some of these are already interpreted as numbers. Provided that a mixture of capitals and lower case characters is accepted, the first six letters of the alphabet are unique.

Thus:

9 10 11 12 13 14 15 .

If displayed on a VDU, upper case letters can be used throughout.

A common practice in written work is of indicating, by use of a dollar sign prefix, that a number is in hexadecimal notation; for example, the data line shown above would be: $F9. Alternatively, the American symbol 'hash' (#), representing 'number', is often used.

Note that in hexadecimal notation the base is 16; also that, in the process of adding hexadecimal numbers, all conventional rules apply. An example of such addition is given below; others are quoted in the worked exercise section of this lesson.

Binary	Hexadecimal	Decimal
00111010	3A	58
01011101	+5D	+93
10010111	97	151

TYPICAL TEST QUESTION. Solve the following:

47	7FC3	3470
+1A	+CE1d	+1B00

(The answers appear on p 00 of the test answers book).

If large numbers are added together, there is danger that more than 8-bits will be generated in the answer. The overflow will produce a net 'carry' value. This will occur if the result of the addition of the most significant column is equal to the system base: i.e. 10 decimal, 2 binary, 16 hexadecimal.
(End of extract).

The Second Remote Training Package
Training Kit S.A. Diagnostic

A second Remote Training Package is now available, (Fig. 4) together with a number of hardware items, software programs, measuring equipment, and documentation of lessons, exercises and model answers.

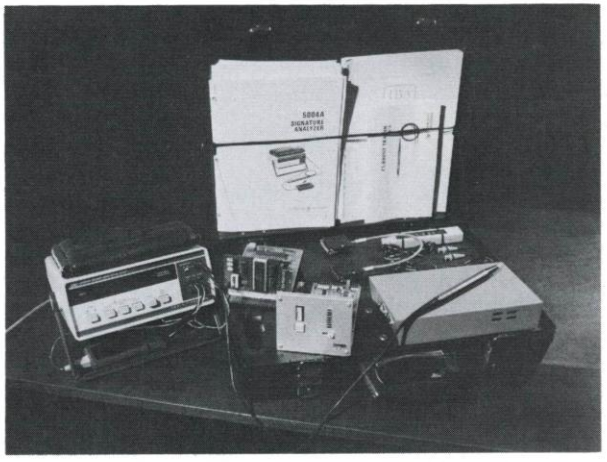


Fig. 4. The training kit S A Diagnostic is based on two microprocessors, the 8085 and the Z80. Boards based on these also contain 'personality' modules which enable simulated faults to be diagnosed using signature analysis techniques.

The need for this training became urgent because of the impending arrival of microprocessor based Channel Four Station and transmitter control equipment.

The equipment in the package comprises:

(*a*) An 8085 Microprocessor Board, 2k ROM, parallel interface, Address Decoding Logic, Timer, Bus Demultiplex, 256 bytes of RAM, Bus Extender Socket and Bus Isolation. This processor was chosen because it is used in the IBA Telemetry and Control systems. The board is constructed and documented such as to permit the application of Signature Analysis. The software includes both serial and parallel Telemetry Control Programs. There is also an Exerciser feature which can be used with the Signature Analysis section.

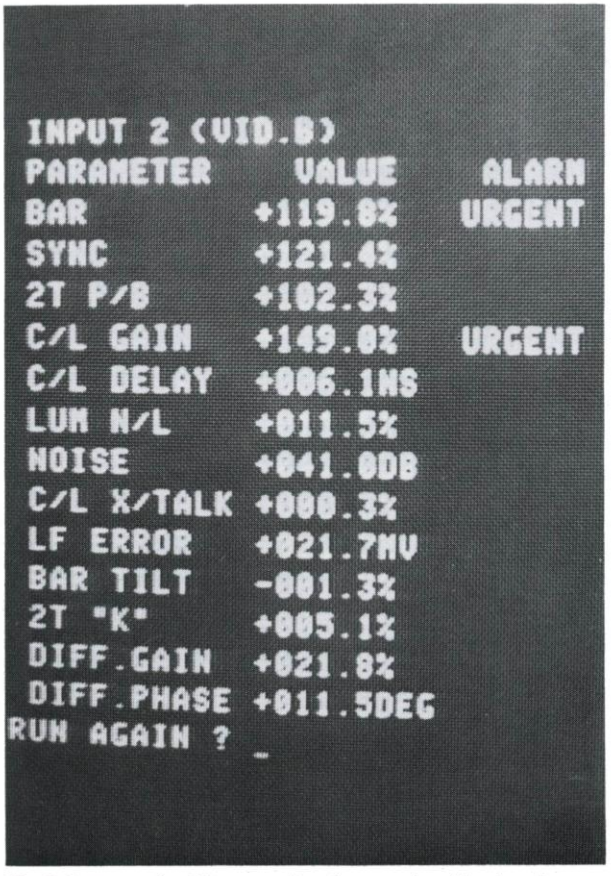


Fig. 5. An example of the type of readout produced by the telemetry simulator. Measurements of the performance parameters of a transmitter are displayed together with any alarm signals as they would be seen at a Regional Operations Centre.

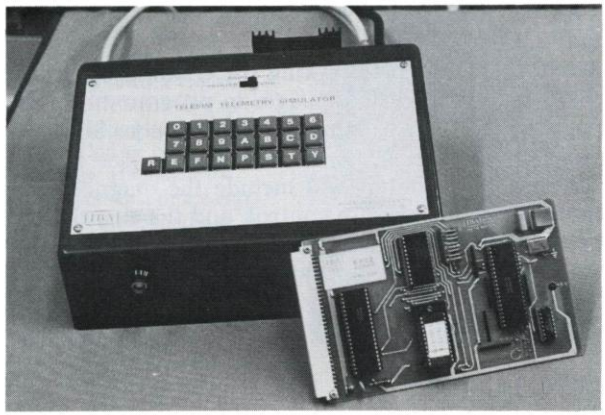


Fig. 6. The telemetry simulator developed at HETC is shown here with its main processor card. A complete keyboard and VDU controller enables the telemetry operations which are to be used at Channel Four Stations to be simulated.

(*b*) A Z80 Microprocessor Board, 2Kbytes of ROM, 1Kbyte of RAM, a parallel Input/Output port, a serial Input/Output port, Address Decoding Logic, a Bus Extension Socket and Bus Isolation. This processor was chosen because it too is used in the IBA Telemetry and Control systems. Software provision is similar to that for the 8085 system, thereby permitting communication between the two boards.

Additional software, faulty and non-faulty, is also included whereby lessons and worked exercises may be conducted in accordance with the fault location section of the training package.

Each Board has various 'personality' front panel modules by which the processor can be adapted to resemble a Transmitter Controller, an RS232 Serial Data system or a General Purpose Interface Bus (GPIB) system, etc. Vectored restarts enable the running of 16 different short software programmes without change of ROM.

(*c*) Logic Probe (included in the On-Station Digital Kit)

(*d*) Logic Pulser

(*e*) Trigger Probe (provided by HETC)

(*f*) Current Probe

(*g*) Signature Analyser (provided by IBA Station Operations Department)

(*h*) A GPIB Adaptor Module, an RS232 Module and a Transmitter Controller Module (produced by HETC).

It is expected that any IBA Station Engineer, having completed both these Remote Training Package courses, will be capable of understanding, and of maintaining the latest IBA station control equipment.

MICROPROCESSOR BASED TELEMETRY SIMULATOR

As a further aid to training, the IBA has designed and built a programmable interface for exercises in routine and handshake with telemetry programme input equipment. This includes facilities for automatically measuring the parameters of distant equipment of the IBA UHF television service (Fig. 5). The functions of this interface are:

(1) To simulate all requests and commands which could be sent from a Regional Operations

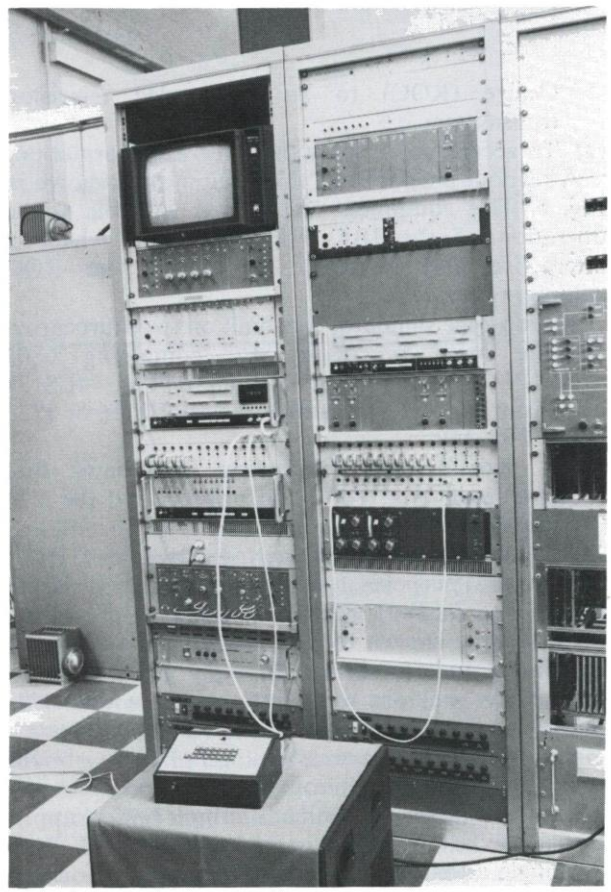


Fig. 7. The equipment in the transmission laboratory at HETC is the same as that found on operational stations. Here the HETC developed telemetry simulator is being used in conjunction with Programme Injection Point (PIP) equipment and Automatic Monitoring Equipment (AME).

Fig. 8. Self-training in high level language programming is carried out using a package designed around the Apple II computer. This is supplied together with disc storage to members of staff together with documentation enabling them to learn at their own speed.

Centre (ROC) to an unattended television transmitter;

(2) To accept and display the returned information.

A readout produced by this equipment is shown in Fig. 6. This equipment has proved valuable in the operation of the IBA PIP equipment, which is interactive and normally handshakes the ROC computing hardware.

A prototype simulator was built on two Eurocards:

(i) The main processor card containing 6802 (CPU/RAM), 6850(ACIA), 6821(PIA), 74LS138 (Address Decoder), and a choice of 2716 or 1732 (EPROM);

(ii) A second card containing the Baud rate Oscillators (for VDU and printer) and the V24 interface circuits.

A double-sided layout was produced at HETC; and, for trial purposes, a small quantity of boards was made by a local PCB firm. Initially, a short trial program was written for interrogating the telemetry equipment and for storing the reply in RAM. Even this simple program was instrumental in disclosing one or two faults actually in the telemetry equipment.

Following the successful completion of the prototype a single self-contained version was produced (see Fig. 6). This unit has in-built power supply, a small dedicated keyboard and a VDU card. With the single addition of a monitor the system forms a complete keyboard/VDU controller. The Simulator Controlling a Programme Injection Point and Automatic Measuring Equipment is shown in Fig. 7.

PROGRAMMING IN HIGH-LEVEL LANGUAGES

The IBA is now undertaking the training of staff in the use of high-level languages in programming. The package designed for this purpose includes an Apple II computer together with disc storage (see Fig. 8). The training syllabus will include the diagnosing of faults through software control, and the examination of data and control systems by use of techniques embracing signature and logic analysis.

CONCLUSIONS

The nature of digital technology is now changing so rapidly that knowledge of systems orientation is a factor more significant than is the understanding of device detail. Hence, the IBA has undertaken a firm commitment to provide training in the techniques of microprocessor and digital systems. Digital television is already present in many laboratories and studios; and, undoubtedly, with the increasing speeds of microprocessors and general logic systems, digital transmission at radio frequencies will soon become possible.

So far the IBA remote training has been directed mainly towards microprocessor operation in the field of control, and to the use of discrete digital components. It is now being extended to include high-level languages and other advanced techniques. The methods of teaching, by residential courses and by remote training schemes, have already evoked strong positive reaction; and this is evidenced, not only in the appreciation shown towards the many training facilities afforded by Harman Engineering Training College but also in the increasing numbers of requests for the hardware associated with the training. Given that this enthusiasm of staff will be maintained, the IBA will continue to adapt the training programme to meet the oncoming techniques of broadcast engineering.

The whole subject of Digital techniques and Microprocessors in Broadcasting and the training implications including the use of remote training packages formed the subject of a paper and presentation delivered in Turkey by the Author in September 1981 to a plenary meeting of the Heads of Technical Training of all Broadcasting Organisations within the EBU.

The text of the paper is likely to be published as an EBU Document.

JOHN LISNEY
served an engineering apprenticeship with Rank Cintel and gained a Higher National Certificate in Industrial Electronics at Croydon College of Technology. He joined the BBC in 1966 as a direct-entry engineer in the Operations and Maintenance Department. After a short period with the Peto Scott organisation, he joined Ravensbourne College as the Senior Engineer appointed to develop the television facilities of the College, where he is now Head of the Department of Television Studies.

Training Operational Technicians for Television Broadcasting

by J. Lisney

Synopsis
Throughout the past fifteen years, the Ravensbourne College of Art and Design, Bromley, Kent, assisted by the nearby Bromley College of Technology, has provided training courses for technicians of the television broadcast industry. Three courses have found favour among those broadcasting organisations responsible for the generation of television programmes. This chapter describes the developments which have led to the production of specialist television courses offered by the Bromley Colleges, and indicates certain plans for future courses.

INTRODUCTION

During recent years of educational development at Bromley a clear pattern has emerged inasmuch as Ravensbourne College has become one of the few, within the UK, to confine media activities primarily to the training of *technicians* and *technician engineers* for the television broadcast industry. The italics are quoted because the terms are general and there is a need to be more concise before proceeding. For example, what exactly is meant by television broadcasting? The IBA provides training for broadcast engineers, but the activities at Ravensbourne College are considerably different from those provided at the IBA training centres.

The College teaching team, in conjunction with its consultative panel (the members of which are drawn mainly from the commercial television contractor companies) consider that the main training requirement for a programme making organisation, which may be loosely described as studio operations, should be at technician engineer level. The term 'studio operations' is indefinite; because not all the activities taking place within a television studio complex would be confined to studio operations, VTR control, networking, line switching, etc. are all tasks performed by people with a variety of skills. If a survey were to be made of the whole of the television industry operating in this country, it is probable that we would find that line switching is being performed by technicians, technician engineers and chartered engineers. This observation merely indicates how difficult it is to clearly define the skills required for any particular task. Also, these skills will vary in accordance with the specific organisation and with the nature of the particular operation taking place.

Fig. 1. A studio using a mixture of camera systems in order to present the engineering student with a variety of approaches to the problem of originating television pictures. Course objectives state that technical aspects of lighting must be presented as a tool with which the engineer/operator may control the technical and aesthetic result achieved for display on the television screen.

THE OBJECTIVE

The definitions laid down by the Council of Engineering Institutions (CEI) for technicians and technician engineers might seem somewhat amusing because classification of any particular task or post within these very closely defined limits is impossible. It is unlikely that the technician working for a television organisation would never be involved in any sort of development work; but many technician engineers spend much time in administration consequently rarely encountering practical maintenance of hardware. However, these definitions, when loosely interpreted, are of use to educationalists. Most of the technical work in the studio complex is performed by persons who are working at technician engineer level. That is to say, the equipment must be kept operational, it must be aligned, and it must be maintained. Seldom do such operations deal with works of either planning or installation. Most of the larger television organisations have separate planning and installation departments. It is the training of operations personnel that is the special activity of Ravensbourne College. This training largely excludes the main IBA transmitter operation, although microwave linking is common to both parties.

What are the skills required of these personnel? In attempting to define them we encounter a major problem. The areas of studio operations and engineering are so diverse that agreement on these skills is practically impossible between engineering managers working in studio operations. This is understandable; but, again if we are to proceed, we need to reach some definition. Can we define the required technical knowledge? In general, the technician should have received a good engineering background in electrical and electronic principles, preferably including digital work and microprocessor/computer work. The usual skills required of technician engineers, perhaps technical drawing, good dexterity in the handling of equipment and knowledge of manufacturing processes of items of hardware etc. can be expected. In deciding these definitions we find evidence that any particular operation will not necessarily require all of the skills; but a college must offer a broad programme of learning objectives which should be steered in the direction specified by the industry. Because of the nature of television broadcasting it becomes desirable

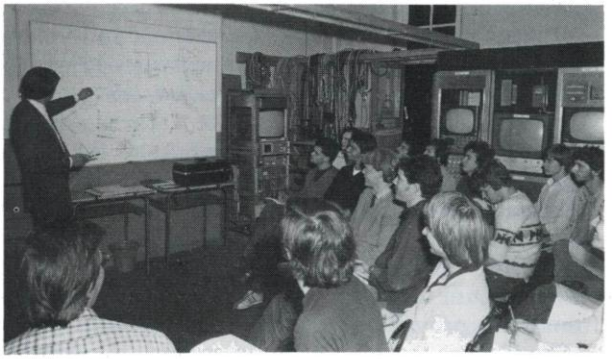


Fig. 2. The vision apparatus area for Studio B is a major teaching and demonstration area. Students are seen studying aspects of colour television theory with vectorscopes, encoders, etc. immediately to hand for demonstration purposes.

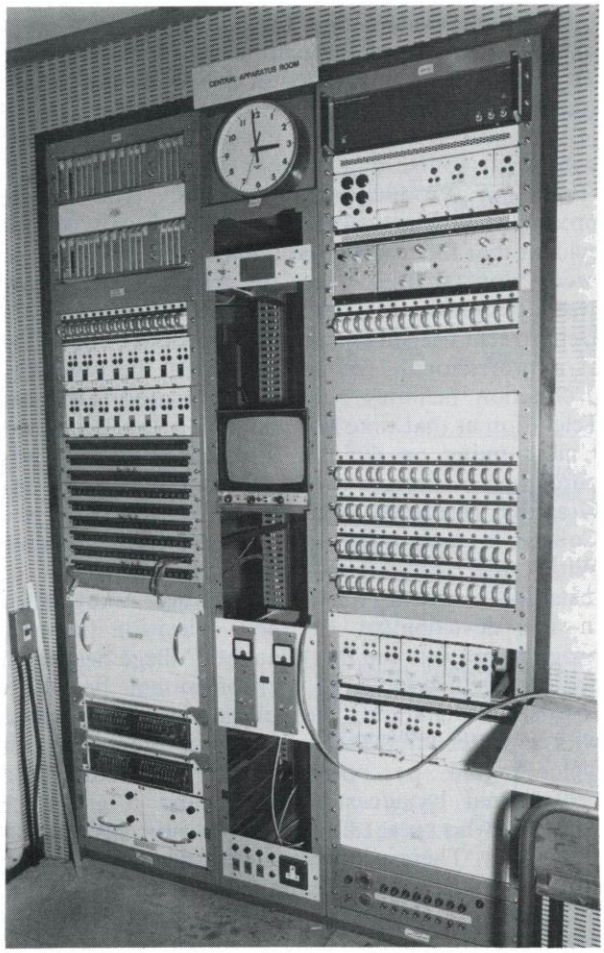


Fig. 3. A view of the central apparatus room for the new installation. Students man this control point, monitoring and routing feeds, test signals, etc. in accordance with normal professional practice.

that the technician engineer be trained in specialist techniques. Hitherto, it has often been considered adequate for a technician engineer to offer either a Higher National Certificate or a City and Guilds qualification in electrical engineering; or, preferably, in electronics/telecommunications or possibly even physics. Indeed this was generally 'Hobson's Choice' since no small industry could reasonably insist that its local technical college should operate a highly specialised television course.

The Technical Education Council (TEC) Higher Diploma in Communications Engineering (Television and Broadcasting) operated at Ravensbourne College is unique. From this programme any young

Fig. 4. Technical control is the main emphasis in the control room vision evaluating. Lighting is on the rear bench with technical supervision equipment in the foreground left and vision mixer to the right.

technician engineer can proceed to holding full technician engineer status; but the course of study has been designed such as to link the electronic, electrical theory, etc, to actual processes taking place within the television broadcast industry.

A revolution in technical education has been brought about by the forward thinking and planning of the TEC, which council has, from the outset, considered that the main criteria for any technician course is that it should be designed for the particular industry concerned. This was achieved only by ensuring that any college proposing to offer a TEC scheme could show clear evidence of consultation with the relevant industry. From time to time they

Fig. 5. Audio engineering operations form an essential part of the course. Here is seen one of the sound control areas, windows to the right of shot look down on to studio floor. The area performs a dual role as a television sound control area and recording studio control suite. The continual emphasis on technical standards is evident by the presence of a considerable quantity of test equipment in the area.

Fig. 6. Practising engineers from Thames Television and London Weekend Television engaged upon microprocessor system evaluation work. This is a part of the 'new technology' short course programme run by the Bromley College of Technology.

have suggested that teaching methods be revised; and always they insist that the learning objectives be clearly defined.

The approach has been welcomed by Ravensbourne College as being in unison with the ordinary level programmes operating in the television department.

HISTORICAL DEVELOPMENT OF TELEVISION TRAINING AT RAVENSBOURNE COLLEGE

In 1965 the Department of Graphics at Ravensbourne College decided that it wished to provide options in Graphics for Television. In order to effect this part-time area of study a small studio of timber construction was provided together with a small adjacent control room and several photographic dark-rooms. The Philips organisation was approached for a package deal using monochrome cameras. At that time colour transmission was at a very early stage of development. This monochrome installation consisted of Vidicon camera channels, one-inch helical VTR (the Philips EL3400) etc. installed as a working programme production unit. The main aim of this provision was that Diploma Graphic Students could opt to spend one or two days each week on work which emphasised the design of graphics for television. A major difficulty with this concept was that a programme had to be generated in order to produce graphics. The enthusiasm of the staff and the students soon led this unit into full scale production, and the college quickly recognised the learning potential of such a system.

It became evident that there was potential for a separate course using this equipment, hence one of the very first television production courses available was conceived. In September 1966 Ravensbourne College of Art and Design went ahead with a two-year vocational course at Ordinary Vocational Level in 'Television Production Techniques'. The course proceeded satisfactorily for a period, but it became evident that the teaching equipment was limited as to production facilities. Since the training programme was designed for professional television, the Department needed equipment that could be operated at a professional level in order that the necessary production facilities could be simulated. Granada Television at that time had available a Pye Broadcast Unit running on 405-line monochrome. This was purchased by the College at an economical price, for Granada Television were pleased to encourage the College in attempting to offer television training. With that equipment came the problems of installation, operation and maintenance. A key factor in the development of their television training programmes was the fact that the College needed to acquire the services of a professional broadcast engineer, which it did. The College was now equipped with a professional standard outside broadcast unit which could be operated into the studio, a professional broadcast engineer, and a group of students who were studying television production techniques. These production students were used to crew their own programme items but there were problems of aligning the equipment, particularly with lighting and sound, because most of the art based students were reluctant to handle the hardware. The teaching team conceived the idea of running a Technical Operators' Course alongside this existing programme, so, in 1967, a tandem vocational course for 'Television Technical Operators' was launched. The two courses ran parallel, each course servicing the needs of the other, until 1978. Much useful work was executed, and much valuable experience gained.

During that eleven year period the television activities were moved into larger accommodation and a small two-studio television complex was developed. Studio A (Fig. 7) has a floor area approximately 220m^2 and ceiling height of 4½m. Studio B (Fig. 8) is of somewhat smaller floor area, but with greater ceiling height and is fitted with telescopic luminaire supports (removed from ABC Didsbury Studios). Appropriate control rooms, telecine, Quadruplex VTR systems etc. were added in such a way as to simulate a small broadcasting studio complex.

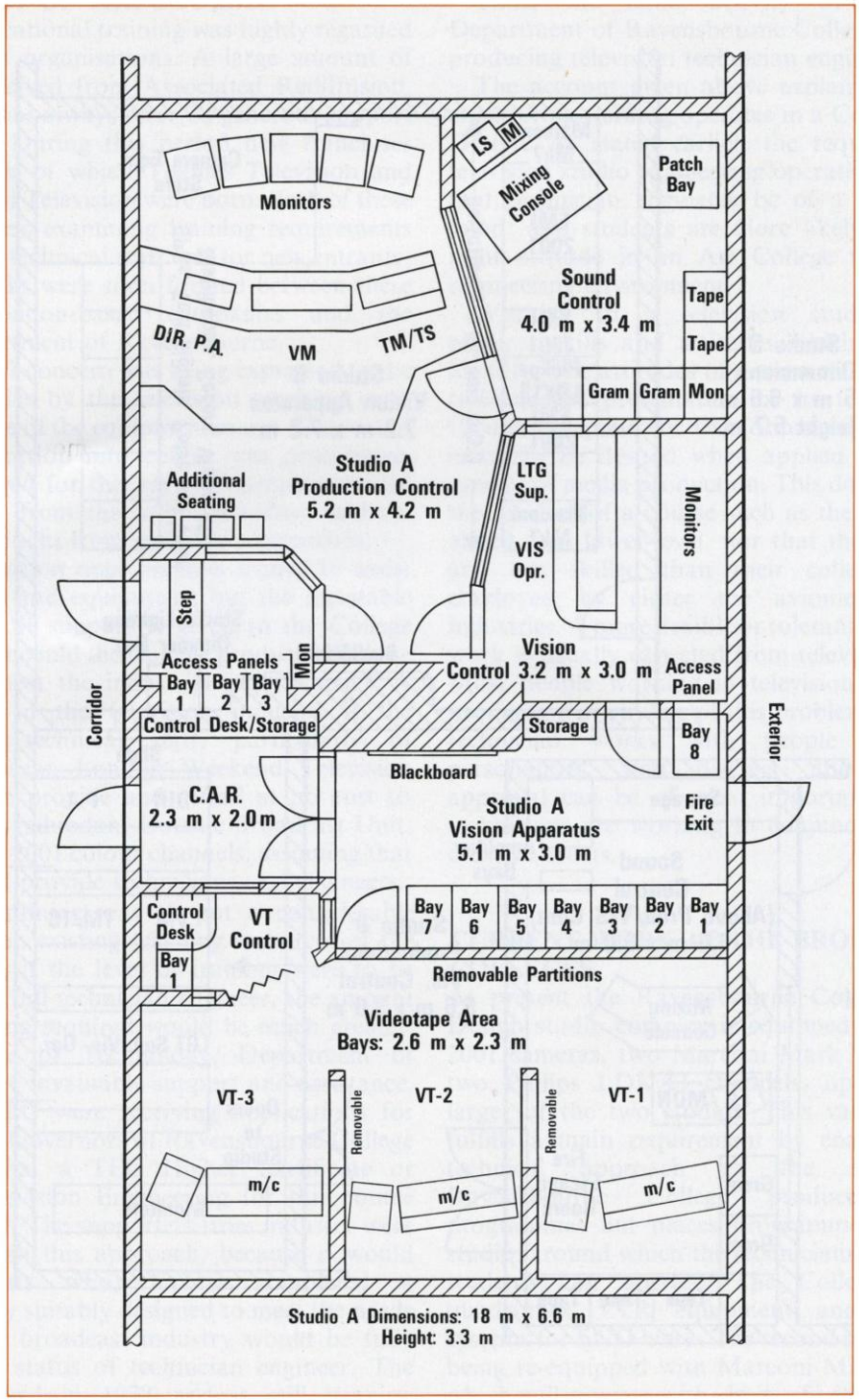


Fig. 7. The Studio A complex caters for all the main operations found in broadcasting. It includes video tape, vision control, sound control, production control and a C.A.R.

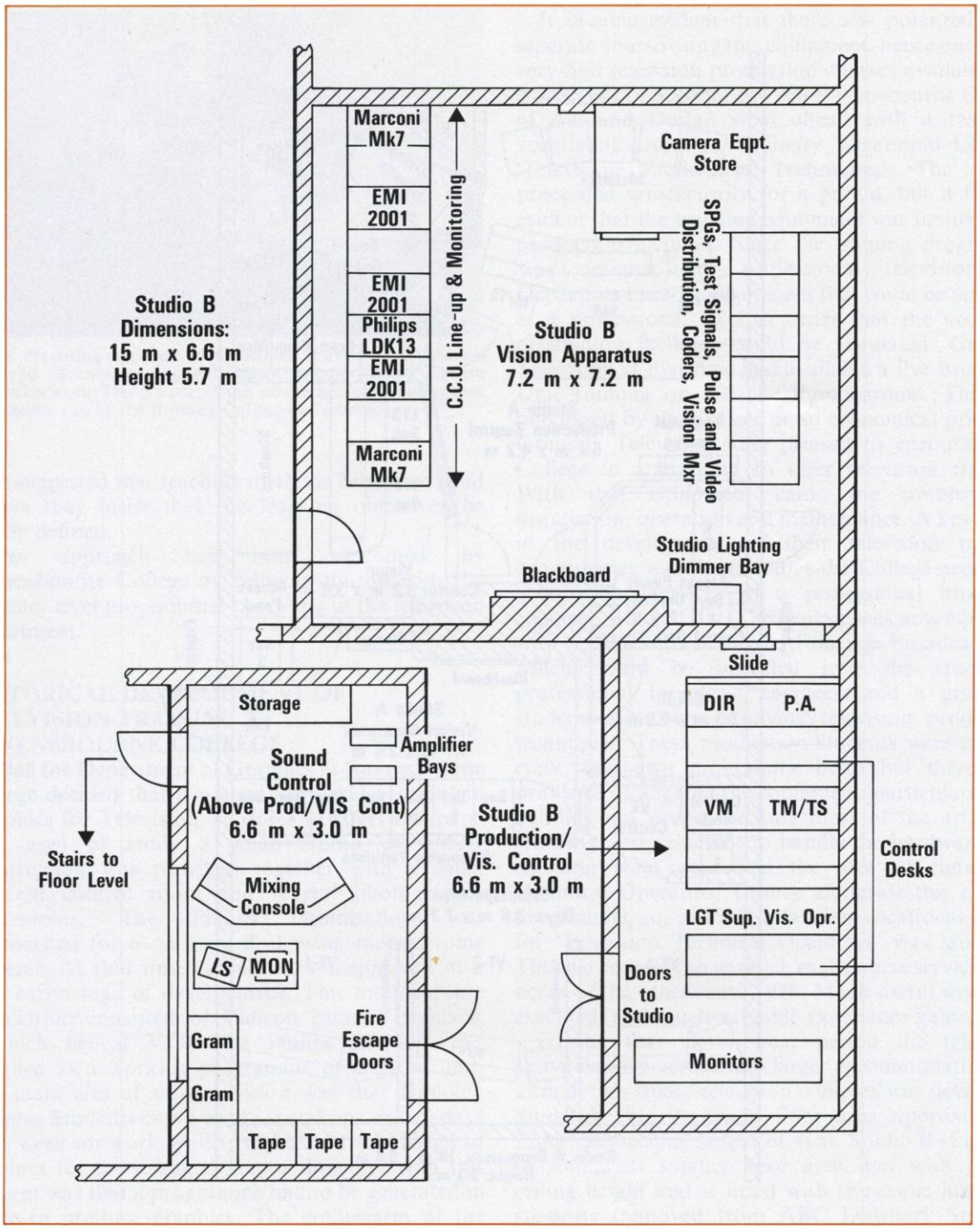


Fig. 8. Studio B, the smaller of the two studio areas, has a greater ceiling height than Studio A which facilitates the use of telescopic luminance supports. A production vision control and a sound control area are provided.

DEVELOPMENT OF THE COURSES

The work of operational training was highly regarded by the television organisations. A large amount of support was received from Associated Rediffusion, and the College has always received generous support from the BBC. During this period new franchises began as a result of which Thames Television and London Weekend Television were born. Both of these organisations were examining training requirements for their existing technical staff and for new entrants; and so, close links were soon formed between these two major London-based companies and the Television Department of Ravensbourne.

During 1976/77 concern was being expressed to the College authorities by the television teaching team because of the age of the equipment in use. The cost of moving the operation into colour was prohibitive. The funds required for this sort of operation would not be available from the local authority; and so, assistance was sought from industrial supporters.

The local television organisations wished to assist in providing aid and equipment; but the inevitable questions were: 'If support is given to the College what end product could the College produce? Will the course output meet the industrial requirement?' A major problem in the television industry is the recruitment of technical staff, particularly of technician engineers. London Weekend Television were prepared to provide and install at no cost to the College their redundant Outside Broadcast Unit, based upon EMI 2001 colour channels, assuming that the course would provide technicians and engineers.

Engineering training was to put a considerable strain on the then existing teaching resources of the College because, if the level of training were to be raised to that of full technician engineer, the amount of formal teaching required would be much greater. Bromley College of Technology, Department of Engineering, gave invaluable support and assistance. At that time TEC were receiving applications for courses, and the Governors of Ravensbourne College recommended that a TEC Higher Certificate or Diploma in Television Engineering for this course should be sought. The supporters from industry were in agreement with this approach, because it would produce students who, having completed a programme study suitably designed to meet the needs of the television broadcast industry would be fully qualified to the status of technician engineer. The course commenced in 1978 and is still running successfully. The TEC will require revalidation of the course syllabus around 1983.

Thus, the main activity of the Television Department of Ravensbourne College is now that of producing television technician engineers.

The account given above explains why it is that engineering training operates in a College of Art and Design. As stated earlier, the requirements of the television studio engineering operation often demand that technician engineers be of a creative turn of mind; and students are more likely to develop the right attitude in an Art College than in a solely engineering environment.

Working in a television studio organisation requires skills and attitudes which are difficult to identify. The attitudes of a normal Technical College towards the presentation of its teaching material, though adequate for the formal engineer, can leave much to be desired when applied to the technical aspects of media production. This does not imply that the product of a course such as the one described is aimed at a lower-level, nor that the technicians are any less skilled than their colleagues who are employed by either the avionics or computer industries. A more flexible or tolerant attitude towards work is usually expected from television technicians. Most people working in television operations and production are aware of this problem. The broadcast technician works with people of contrasting personalities, and discreet and understanding approval can be of great importance when studio technicians are working in conjunction with highly creative artists.

CURRENT WORK AT THE BROMLEY COLLEGES

At present the Ravensbourne College of Art and Design studio complex is equipped with three EMI 2001 cameras, two Marconi Mark VII cameras and two Philips LDK 13 channels, operating into the larger of the two studios. This variety of cameras fulfills a main requirement by enabling a varying technical approach to the same problem. Ravensbourne College produces no actual programmes but places programme items into the studio, around which the technicians and engineering students can operate. The College works with quadruplex VTR equipment and also U-matic systems for ENG work. The second studio is currently being re-equipped with Marconi Mark VII channels which will operate with similar facilities. The designs of the control rooms for the two areas are somewhat different. Studio B, which is the current colour

installation, is designed primarily as a teaching area. Consequently the central apparatus and vision apparatus areas, pulses and pulse routing, etc. form two walls of a classroom. In this room a large amount of practical demonstration and formal teaching takes place. The new installation, now under construction, is more complex in layout and much more akin to the standard format to be found in any studio complex. This installation is planned as a programme making unit. Groups of technician students, having acquired the skills necessary as fully operational crews, will work in this unit during the later period of their training course.

COURSE ENTRY REQUIREMENTS AND CONTENT

The full-time course is of two years duration with an 'A' Level Maths and Physics entry requirement. Successful candidates are carefully selected by interview, and an entry examination. It is unlikely that any candidate will gain a place on the course unless able to demonstrate an enthusiasm for the media, and particularly for working with media hardware. Prospective students are often Hi-fi enthusiasts, or have had occupational experience in the theatre, hospital radio, school CCTV etc. Usually they have attempted to obtain information about the television broadcast industry, possibly by having visited television studios. Unfortunately, among the misinformed, the College of Art image, coupled with frequent mention of operations in television, tends to be misconstrued, such that these activities are sometimes regarded as being of a non-technical or low-level nature. Hence, many applications are received from students who lack technical interest. These are unacceptable; because the main objectives of the TEC Higher Diploma Course, are two years of intensive engineering study leading to attainment of high technical ability. The production of high quality television pictures, and of sound to full code of practice specifications are the ultimate objects of this training; and every accepted student is made aware of his prime responsibility. The syllabus covers all the usual items of any technician engineering course. Much of the study time is devoted to the theories of digital techniques, digital circuitry, and microprocessors, and the practical work embraces maintenance, fault locating, circuit analysis, networks, attenuators, filters and all allied subjects included in the syllabus.

Much of the teaching is given by former broadcast engineers and by visiting lecturers from Thames Television or from London Weekend Television. Thus, students are taught by persons able to present these topics in the correct context. For example servo systems, and second order differential equations are discussed using as an example of classical servo theory, a VTR servo system. In recent years the link with the Bromley College of Technology has strengthened. About four years ago, London Weekend Television and Thames Television requested short updating courses in digital techniques, and the Joint Board of Studies of the two Colleges gave favourable consideration to this request. All the hardware required for digital work was available at the Laboratories of the Bromley College of Technology, and instruction on the application of digital techniques in television was available from staff of the Television Department of Ravensbourne College. Thus was produced a successful series of ten day in-service digital training courses. An important factor contributing to the success of these courses was that digital techniques could be discussed in context. The main training programme was written by lecturers experienced in the teaching of basic digital concepts such as Boolean Algebra, sequential logic, etc. Other parts of the programme included discussions on A-D Converters for video pulse code modulation techniques, problems associated with serial digital standards for Teletext and video etc. These ten-day courses in digital techniques now need extending; and further programmes are being written such that training in the applications of digital and microprocessor systems to modern video and audio broadcasting can be further developed. These courses have been so successful that Thames and London Weekend Television regard this updating process for their technicians as being an on-going commitment. Other short programmes for in-service training have been written. The Television Department operates a course in basic television technology for the benefit of young trainee operators. Courses now under development include 'Colour Television Engineering' of three to four weeks duration. For several years past, a four week ENG course has been in operation, exclusively for personnel of Independent Television News (ITN); and a similar course will soon be available to other users. A further course in Video Tape Technology is now being developed to answer the call for video tape operators working on tape duplicating processes, where technicians must deal with a wide variety of systems from quadruplex, through 'C' format to VHS.

WHAT OF THE FUTURE?

The interest of the Colleges in 'self-financing' courses has grown. Tuition fees charged for current courses assist in the development of further courses, hence this is a realistic way of fulfilling specialist training requirements for the broadcast industry.

As to full-time courses, the current TEC programme is successful, although far from perfect. It was the first TEC course of its type to be validated and is firmly established; but it now needs updating and will undergo major modifications. There is, however, a gap. The College continuously receives requests for trained television operators. Unfortunately, training at operational level for television is seen to be incompatible with the educational pattern currently operating in this country.

The type of problem may best be illustrated by considering the training of a television cameraman. Most technicians engaged in television broadcasting would agree that skills for television camera work are extremely sophisticated. They would also agree that, at present, there is in the UK no formalised national training scheme for television cameramen. Perhaps such a programme could be introduced at Ravensbourne College. Any such course for cameramen could cover only the essential ground work. Any successful student from such a course could be expected to enter a television organisation as a junior operator. The employer would know that the trainee had been given an opportunity to verify his choice of career, and might therefore confidently proceed to engage the trainee first on minor operational work and subsequently steering him or her carefully towards the establishment of an experienced camera person.

Most training managers agree that such a course would be of much value. Unfortunately, the apparent simplicity of operational skills required for camera work would tend to classify the teaching programme as being at non-advanced level. This educational pattern would dictate that a student, starting at 16 years of age, would spend two years at College on a vocational study in television camera work, and at the age of 18 would join an organisation as indicated above. There is a possibility that the College could operate such a scheme and that the process would be satisfactory; but there are problems inherent on the classifying and grading of any course rated at this level. A technician of this grade would work at the level of a mechanic. Therefore, such students would not qualify for mandatory grants; and, in the current economic climate, there is no guarantee that the student would obtain any financial assistance at all. This, in turn, produces a problem of recruitment of students. With low-level courses of this nature there are staffing restrictions. The teaching grades are at the lower end of the Burnham Scale, while the staff/student ratios are high. The difficulty arises in convincing the education authorities that television camera work is not necessarily of low-level. There tends to be an assumption that, if students do not evaluate differential equations etc. then the programme offered must be classified as low-level. Cannot a course at Advanced Vocational Level for television cameramen be justified? Television management find this incompatibility of the educational system difficult to comprehend. Most Colleges operate under very severe restrictions on establishment. The nature of the syllabus and of the work that could be put forward, although perhaps fulfilling the need of the local television station, probably would not meet the standards required by the Department of Education; hence, the College is unable to offer the facilities that local industry requires. If the course now proposed could become entirely self-financing, the problem would be largely alleviated. This is practicable for short courses of, say, ten days duration; but any two-year course if totally self-financed, would be a very expensive operation.

The Ravensbourne College of Art and Design, in conjunction with Leeds Polytechnic, are currently examining this problem. So far as the Bromley Colleges are concerned the survival of existing training programmes depends upon the expansion of those self-financing activities. As with farming, the larger the operation, the more likely it is to be viable. Brief and self-financing programmes offer an attractive option to the College in the current economic climate. It is hoped that with the new franchises now in operation, a clearer picture will emerge among the various contractual organisations, leading to a more clearly defined training requirement that can effectively be implemented.

One day we may have a training scheme as effective and as well structured as that operated by the IBA for their operational staff.

Le College Harman de Formation d'Ingénieurs, Seaton

Par W. A. Atherton

Résumé

Tout comme les autres domaines de l'électronique, la radiodiffusion-télévision constitue une branche vaste et en constante transformation de l'ingénierie moderne.

Les ingénieurs, nouvelles recrues du monde de la radiodiffusion-télévision ainsi que les ingénieurs chevronnés doivent nécessairement suivre une formation répétée s'ils veulent se maintenir au courant des dernières innovations et effectuer leur profession de manière efficace et effective. Le Collège Harman de Formation d'Ingénieurs organise et assure des cours internes et externes de formation professionnelle, couvrant les domaines particuliers des techniques de radiodiffusion-télévision. La plupart, mais non la totalité des étudiants appartiennent à l'IBA.

Formation à la Technique de la Télévision au sein de L'Ecole Polytechnique de Leeds

Par D. Leahy

Résumé

Au sein de l'Ecole Polytechnique de Leeds, l'Ecole de Techniques Electriques assure certains cours brefs de formation des ingénieurs de télévision. Cet article décrit comment, après un début modeste, ces cours ont pris de l'envergure pour devenir les principales matières du programme pédagogique de l'Ecole. D'importants équipements ont été achetés par l'IBA, plusieurs sociétés de programmes télévisés ainsi que des organisations productrices. Alliés à un réinvestissement judicieux des revenus des cours brefs, ces acquisitions ont permis à l'Ecole d'offrir d'importants équipements de laboratoire pour la formation courte.

Formation Technique au sein de la Société Thames Television

Par J. E. Tasker

Résumé

Le service de formation de la société Thames Television a été créé officiellement environ trois ans après la mise sur pied de la société même, dans le but d'offrir un enseignement technique aux nouvelles recrues de cette industrie. Les étudiants suivent un cours d'une année, dont neuf mois d'enseignement placé sous le contrôle du service de formation et couvrant les principes fondamentaux ainsi que la formation pratique dans diverses sections de la société.

Des cours sur d'autres matières sont également offerts aux employés de la société, y compris le personnel non technique, et des cours techniques avancés couvrent des domaines tels que les nouveaux équipements et la technologie numérique. Les relations avec d'autres établissements de formation sont très étroites et touchent également des organismes professionnels au sein de l'industrie.

Formation de L'Ingénieur au Fonctionnement et à L'Entretien des Studios—Optique de L'Ecole Nationale de Radiodiffusion-Télévision

Par B. Tilcock

Résumé

Organisme indépendant bénéficiant de l'appui de l'Independent Broadcasting Authority (Administration Autonome de Radiodiffusion-Télévision), L'Ecole Nationale de Radiodiffusion-Télévision offre une formation professionnelle à la production de programmes radio, au journalisme, à l'ingénierie, à la gestion et au soutien technique offert aux ingénieurs. Des cours spécialisés orientés vers l'ingénierie offrent une formation complète, du stade fondamental de recrutement à un niveau plus perfectionné visant ceux déjà employés dans le domaine de la radiodiffusion. Des cours existent également pour l'apprentissage de nouvelles techniques telles que les techniques numériques. La mise en pratique réelle de l'enseignement est présente à tous les stades et entraîne l'utilisation des moyens importants offerts par l'école sous forme de studio et équipements de montage et de travail en extérieur.

Diplôme d'Ingénieur de Radiodiffusion-Télévision de L'Ecole Polytechnique de Newcastle upon Tyne

Par A. Ritchey

Résumé

L'Ecole Polytechnique de Newcastle upon Tyne englobe au sein de sa faculté d'ingénierie une importante école d'ingénieurs en électronique. Avec l'aide de la faculté de physique, cette école fournit un cours de vingt-sept semaines, organisé selon les besoins du programme de formation d'ingénieurs de l'IBA. Enseignant la théorie générale et les principes de l'ingénierie électronique au moyen d'un programme mis au point conjointement avec le Groupe de formation technique de l'IBA et le Service d'exploitation et d'entretien de station, ce cours constitue le complément de la formation spécialisée des ingénieurs de radiodiffusion-télévision offerte par le Collège Harman de formation d'ingénieurs de l'IBA et fait ainsi partie intégrante de la formation dispensée aux étudiants-ingénieurs en radiodiffusion-télévision.

Programmes IBA de Formation Interne et "A Distance"

Par A. W. Reading

Résumé

Le progrès rapide de la technologie de l'électronique, produisant de nouveaux systèmes à un rythme toujours croissant, engendre des problèmes spéciaux de formation des ingénieurs de radiodiffusion, dont un grand nombre de tâches se modifient à la même vitesse. Cet article présente les principales méthodes de formation appliquées par l'IBA et en particulier un plan "d'apprentissage à distance" invitant chaque membre du personnel à étudier à son gré et à sa propre vitesse d'assimilation. Cette innovation au sein de l'IBA s'est révélée efficace et économique mais a également été favorablement accueillie par le personnel local et le personnel technique du Siège.

Formation des Techniciens Opérateurs de Diffusions de Programmes Télévisés

Par J. Lisney

Résumé

Au cours des quinze dernières années, le Collège d'Art et de Dessin de Ravensbourne, Bromley, dans le Kent, a assuré avec l'aide du Collège voisin de technologie de Bromley des cours de formation des techniciens du monde de la télévision. Trois cours ont été favorablement accueillis par les sociétés de programmes responsables de la création des émissions de télévision. Cet article décrit la suite d'événements débouchant sur la mise en place de cours spécialisés dans la technique de la télévision au sein de ces collèges de Bromley, et donne quelques projets de cours à venir.

Harman Engineering Training College, Seaton

von. W. Atherton

Überlick

Die Rundfunktechnik, gleich anderen mit der Elektronik verbundenen Gebieten, umfaßt einen breiten Bereich der modernen Technik, auf dem laufend Veränderungen stattfinden. Ingenieure, für die die Rundfunktechnik neu ist, sowie auch solche, die auf diesem Gebiet bereits Erfahrung besitzen, müssen ihr Fach erlernen bzw. immer wieder dazu lernen, wenn sie in ihrem Beruf auf dem Laufenden bleiben und diesen wirkungsvoll und effizient ausüben wollen. Das Harman Engineering Training College befaßt sich mit der Planung und Durchführung interner und externer Ausbildungslehrgänge in den Fachbereichen der Rundfunktechnik. Die meisten, aber nicht alle, Kursteilnehmer, gehören zu IBA.

Leeds Polytechnic—Schulungskurse in Fernsehtechnik

von D. Leahy

Überblick

An der Schule für Elektrotechnik, die zur Leeds Polytechnic gehört, werden kurzfristige Schulungskurse für Fernsehtechniker angeboten. In diesem Artikel wird beschrieben, wie sich diese Kurse aus kleinen Anfängen heraus zu bedeutenden Fächern des Lehrplanes der Schule entwickelt haben. Wichtige Ausrüstungsgegenstände wurden von der IBA, sowie von verschiedenen Programmgesellschaften und Herstellern erworben. Mit Hilfe dieser Ausrüstungen sowie einer überlegten Wiederanlage der aus den Kurzkursen stammenden Erträge konnten bemerkenswerte Laboreinrichtungen erstellt werden, die bei der Schulung der Kurzkursteilnehmer zum Einsatz kommen.

Fachtechnische Schulung bei Thames Television

von J. E. Tasker

Überblick

Die Schulungsabteilung von Thames Television wurde drei Jahre nach der Gründung von Thames Television zur fachtechnischen Ausbildung neu eingestellter Kräfte eingerichtet. Die Ausbildungskurse dauern ein Jahr, wobei die Auszubildenden neun Monate der Schulungsabteilung unterstehen. Der Lehrplan umfaßt die Unterrichtung in den Grundbegriffen sowie die praktische Ausbildung in den verschiedenen Abteilungen des Unternehmens.

Auch auf anderen Gebieten werden Kurse angeboten, an denen die Angestellten des Unternehmens einschließlich nicht-technisches Personal teilnehmen können, und in weiteren technischen Kursen werden solche Gebiete wie neue Geräte und Digitalverfahren behandelt. Außerdem wird ein reger Kontakt mit anderen Schulungsinstituten sowie mit beruflichen Körperschaften dieses Industriezweiges unterhalten.

Ausbildung von Technikern an der National Broadcasting School in Studioarbeiten und Studiowartung

von B. Tilcock

Überblick

An der National Broadcasting School, einer von IBA unterstützten unabhängigen Fachschulorganisation, werden Rundfunktechniker auf den Gebieten Produktion, Journalismus, Technik, Management und Weiterentwicklung ausgebildet. Fachkurse in Rundfunktechnik mit einem umfangreichen Programm umfassen nicht nur Grundkurse für Anfänger, sondern auch fortgeschrittene Kurse auf höherer Ebene für diejenigen, die bereits in der Rundfunkindustrie arbeiten. Ferner werden Lehrgänge in neuen Technologien wie z.B. Digitalverfahren angeboten. Auf sämtlichen Ausbildungsstufen spielt die praktische Ausbildung, wie Bearbeitung, Außenreportage usw., für die die Schule weitläufige Einrichtungen und Studios besitzt, eine wichtige Rolle.

Sendeingenieur-Diplom des Polytechnikum Newcastle upon Tyne

von A. Ritchey

Zusammenfassung

Das Polytechnikum Newcastle upon Tyne besitzt innerhalb der Fakultät Ingenieurwesen eine große Elektronikingenieur-Schule. Diese Schule bietet in Zusammenarbeit mit der Physik-Schule einen 27-wöchigen Kursus, der auf die Bedürfnisse des IBA (unabhängige Sendeanstalt) Ingenieur-Trainingsprogramms zugeschnitten ist. Mittels eines Lehrprogramms, das gemeinsam von der Technischen Trainingsgruppe und der Abteilung Sendeanstaltsbetrieb und -instandhaltung des IBA aufgestellt wurde, behandelt der Kursus allgemeine Theorie und die Grundsätze des Elektronikingenieurwesens. Dieser Kursus ergänzt das Spezialtraining im Sendeingenieurwesen, das das Harman Engineering Training College, welches der IBA gehört, bietet, und er ist ein wesentlicher Bestandteil des Sendeingenieur-Trainingsprogramms.

IBA—Seminare und Fernkurse

von A. W. Reading

Überblick

Die schnelle Weiterentwicklung der auf der Elektronik basierenden Technologien und die damit verbundene ständige Zunahme neuer Systeme bringt spezielle Probleme in der Ausbildung von rundfunktechnischem Personal mit sich, da sich in vielen Fällen die Aufgabengebiete dieser Fachkräfte mit der vorerwähnten Weiterentwicklung verändern. In diesem Vortrag werden die von IBA verwendeten hauptsächlichen Ausbildungsmethoden beschrieben, und zwar insbesondere ein 'Fernstudium', das dem Einzelnen gestattet, seine Studien nach Belieben zu betreiben und sein Lernpensum ganz seiner Aufnahmefähigkeit anzupassen. Innerhalb von IBA hat dieses neuartige und, nebenbei gesagt, effiziente und rationelle Programm bei Außendienstkräften wie auch bei technischem Personal der Hauptverwaltung großen Anklang gefunden.

Schulung von Betriebspersonal für den Fernsehrundfunk

von J. Lisney

Überlick

Seit fünfzehn Jahren werden am Ravensbourne College of Art and Design sowie an dem nicht weit davon entfernten Bromley College of Technology Schulungskurse für biem Fernsehen angestellte Techniker abgehalten. Drei dieser Kurse werden von denjenigen Rundfunkorganisationen, die für die Aufstellung der Fernsehprogramme verantwortlich sind, besonders anerkannt. In diesem Artikel werden die Entwicklungen beschrieben, die zur Einrichtung der Spezial-Fernsehkurse an den Bromley Colleges geführt haben; ferner wird über bestimmte Pläne für zukünftige Kurse berichtet.

La Escuela de Formación de Ingeniería Harman, Seaton

por W. A. Atherton

Resumen

La ingeniería de radiodifusión, lo mismo que otras ramas de la ciencia electrónica, es un campo de la ingeniería moderna de gran variedad y rápido cambio. Los ingenieros que empiezan a trabajar en radiodifusión, y los ingenieros de radiodifusión ya establecidos, tienen que adiestrarse y volverse a adiestrar si quieren mantenerse al día y desempeñar eficaz y eficientemente su profesión. La Escuela de Formación de Ingeniería Harman establece y desarrolla cursos internos y externos para el adiestramiento vocacional en las diversas especialidades de ingeniería de radiodifusión. La mayoría de los estudiantes, aunque no todos, proceden de la IBA.

Formación para Emisoras de Televisión en la Escuela Politécnica de Leeds

por D. Leahy

Resumen

La Escuela de Ingeniería Eléctrica dentro de la Politécnica de Leeds ofrece varios cursos de formación de corta duración para ingenieros de emisoras de televisión. Este artículo describe cómo, empezando modestamente, estos cursos se han convertido en los elementos principales del programa de la Escuela. Se han adquirido importantes instrumentos de equipo de IBA, así como de varias compañías programadoras y diversos fabricantes. Mediante esto, junto con la reinversión juiciosa de los ingresos procedentes de los cursos, se ha conseguido que la Escuela disponga de instalaciones suficientes para el adiestramiento en cursos cortos.

Formación Tecnica dentro de Thames Television

por J. E. Tasker

Resumen

El departamento de formación de Thames Television fue establecido formalmente unos tres años después de la constitución de Thames Television con el objeto de proporcionar entrenamiento técnico a los nuevos reclutas de la industria. Los alumnos siguen un curso de un año, nueve meses del cual transcurren bajo el control del departamento de formación, cubriendo los principios fundamentales y el adiestramiento práctico en varias secciones de la compañía.

También se imparten cursos en otras disciplinas a los empleados de la empresa incluyendo el personal no técnico, y otros cursos técnicos cubren temas como nuevo equipo y tecnología digital. Existe también gran colaboración con otras instituciones de capacitación y entidades profesionales relacionadas con la industria.

Formación del Ingeniero en Operaciones de Estudio y Mantenimiento—Enfoque de la Escuela de Radiodifusión Nacional

por B. Tilcock

Resumen

La Escuela Nacional de Radiodifusión, entidad independiente patrocinada por la IBA, ofrece a los ingenieros formación profesional en Producción de Radio, Periodismo, Ingeniería, Dirección y Apoyo de Desarrollo. Los cursos especializados enfocados hacia ingeniería, proporcionan una gama completa de instrucción desde los fundamentos o nivel de iniciación, hasta un nivel más complejo dirigido a los que ya están empleados en la industria de radiodifusión. También se imparten cursos para adiestramiento en nuevas tecnologías, como las técnicas digitales. Hay una gran cantidad de ejercicios prácticos en todas las etapas, haciéndose uso de las amplias instalaciones de estudio, edición y radiodifusión.

Diploma de Ingeniería de Radiodifusión de la Politécnica de Newcastle upon Tyne

por A. Ritchey

Resumen

La Politécnica de Newcastle upon Tyne tiene una gran Escuela de Ingeniería Electrónica dentro de la Facultad de Ingeniería. La Escuela imparte un curso de veinte y siete semanas, con la ayuda de la Escuela de Física, adaptado a las necesidades del programa de adiestramiento de ingeniería de la IBA. Cubriendo la teoría general y los principios básicos de ingeniería electrónica por medio de un programa proyectado conjuntamente por el Grupo de Formación Técnica de IBA y el Departamento de Operaciones de Estación y Mantenimiento, este curso complementa el adiestramiento especial en ingeniería de radiodifusión dado en el Colegio de Formación de Ingeniería Harman perteneciente a IBA, y forma parte integral del entrenamiento dado a los ingenieros estudiantes de radiodifusión.

Programas de Formación Residenciales y a Distancia de IBA

por A. W. Reading

Resumen

El rápido avance de la tecnología electrónica, con su incesante producción de nuevos sistemas, plantea problemas especiales de entrenamiento del personal de ingeniería de radiodifusión, muchos de cuyos cometidos cambian con dichos avances. Este escrito describe los métodos principales de entrenamiento aplicados por la IBA y, en particular, un programa de "enseñanza a distancia" por el que a cada miembro individual del personal se le anima a estudiar, a voluntad, y a su propia velocidad de aprendizaje. Dentro de la IBA, este nuevo sistema, además de ser eficaz y económico, ha sido acogido favorablemente por el personal de compo y por el personal de ingeniería de la casa central.

Formación de Tecnicos Operadores para Emisoras de Televisión

por J. Lisney

Resumen

A través de los últimos quince años, el Ravensbourne College of Art and Design, Bromley, Kent, ayudado por el vecino Bromley College of Technology, ha proporcionado cursos de adiestramiento para técnicos de la industria televisiva. Tres cursos han sido favorecidos por aquellos organismos de radiodifusión encargados de la producción de programas televisivos. Este artículo describe los desarrollos que han conducido a la producción de cursos de televisión especializados ofrecidos por los Bromley Colleges, e indica ciertos planes para cursos futuros.

NOTES

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